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ABSTRACT

A project was designed to develop curricula in manufacturing occupations for grades 9 through 12, and to test, modify, reproduce, and disseminate the results. To enhance the dimensions of the operation a committee from Fairleigh Dickinson University and the New Jersey State Department of Education staff was formed to ensure effective achievement of the goals, and a national advisory committee supplemented contacts with industry. A pretest and a pilot test gave students and teachers an opportunity to use the materials developed and respond to questions by project staff. The material was modified, language and content simplified, and four booklets (see related note) were printed: "Exploring Manufacturing Occupations - Students' Manual," "Exploring Manufacturing Occupations - Instructor's Guide," "Occupational Preparation - Inspection and Quality Control - Student's Manual," and "Occupation Preparation - Inspection and Quality Control - Instructor's Guide." The bulk of this report is contained in the appendixes which include a project progress report, outlines for preparation of a teacher's guide and a student resource manual, tabulated results of the pre- and posttests, final report of the pilot tests, teacher questionnaires concerning the material, sample learner activities, and pre- and posttests. (BL)

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ED149134

FINAL REPORT

JOB CLUSTER FOR

MANUFACTURING OCCUPATIONS

AT THE

HIGH SCHOOL LEVEL

USOE GRANT #OEG-0-71-4687(357)

SUBMITTED BY:

NEW JERSEY DEPARTMENT OF EDUCATION

DIVISION OF VOCATIONAL EDUCATION

225 WEST STATE STREET

TRENTON, NEW JERSEY 08625

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

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AUGUST 1977

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OE 014 413

ABSTRACT

The New Jersey Department of Education was awarded an initial grant from the United States Office of Education under the provisions of Part I of the Vocational Education Act of 1968. The grant in the amount of $150,000 was for the purpose of developing curricula in manufacturing occupations for grades 9 through 12.

The initial grant period of 6/30/71 - 12/30/72 was extended until 12/31/74 with the sum of $250,000 being added. The total project cost therefore represents $400,000. Subsequently the project was extended until June 30, 1975 at no additional cost to the government.

The goal of the grant was to develop curricula, test, modify, reproduce and disseminate the results. To enhance the dimension of the operation an agreement was reached with Fairleigh Dickinson University to work in concert with the Department of Education. An operational committee of university and department staff was formed to ensure the effective achievement of the goals. In addition a National Advisory Committee was formed which was supplemented by contacts with industry involved in manufacturing operations.

Testing was accomplished through a pre-test and pilot test in Knoxville, Kentucky, and San Diego, California. Students and teachers had an opportunity to use the materials developed and respond to questions formulated by project staff. An evaluation of the pilot test revealed curricular weaknesses which were subsequently corrected by modifying the material prior to reproduction. Language and content was simplified considerably to make it more adaptable to students at the high school level.

Four manuscripts were completed and printed by the Government Printing Office. Dissemination was made by the Government Printing Office during February 1977 in accordance with the dissemination plan provided by the USOE. A total of 2283 sets of four books were distributed to State Curriculum offices, National Curriculum Network Coordinators, Office of Education Regional Offices, Advisory Committee members, and the USOE project staff.

Project Staff

New Jersey Department of Education

A.C. Buchanan-Project Director
Richard Chalfant-Researchist
Sherwood Gordon-Researchist (1 year)

Fairleigh Dickinson University

Dr. Charles Moffett-Project Coordinator
Ms. Nancy Dillenberg-Assistant to the Coordinator

APPRECIATION

Sincere appreciation is extended to countless individuals from Governmental Agencies, Education, Organized Labor and Industry who generously participated in this project giving of their time freely.

Their collective expertise has resulted in a set of curriculum guides for students and teachers in the broad field of manufacturing occupations.

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PART I

INTRODUCTION AND HISTORICAL EVOLVEMENT

The present-day national program of Career Education began early in 1971. After establishing 15 "clusters" of occupations under the direction of Sidney P. Marland, then U.S. Commissioner of Education, contracts were let for pilot programs in five clusters. The grantees met in Washington on June 14, 1971 for a preliminary discussion. The basis of this discussion was a paper entitled: Career Education -- A Model for Implementation. The grantees and their assigned clusters were: California, Public Service Occupations; New Jersey, Manufacturing; Ohio, Transportation; Oregon, Communications and Media; and Texas, Construction. The fifteen "clusters" of which the above are a part, are described in a publication entitled Career Education, (DHEW Publication No. (OE) 73-00501, published in 1971).

Two principal factors determined the choice of New Jersey as the site for the Manufacturing Cluster. First, was the presence of many manufacturing establishments of all sizes and product designations in a comparatively small geographic area. A second reason was the climate for occupational education in the state. In New Jersey the opportunities for a student begins with Technology for Children in the lower grades, and form a continuum through Introduction to Vocations, Industrial Arts and/or Vocational Education at junior and senior high school grade levels, and beyond, through the county and state-operated college systems. This environment was further enhanced by the presence of a strong "Career Development" program, which was well under way when the Career Education contracts began, all of which made New Jersey ideal for the awarding of the Manufacturing Cluster grant. The Governor's Career Development Program, funded pilot/demonstration programs in a number of New Jersey communities, and paved the way for the smooth transition to a state-wide Career Education emphasis.

The "Manufacturing" project was initiated by a grant from the United States Office of Education, designated as Grant No. OEG-O-71-4687 (357). The initial grant, in the amount of $150,000.00 was from July 1, 1971 to December 31, 1972. The original contract was later amended for the period of January 1, 1972 through December 31, 1974. This amendment was in the amount of $250,000.00.

In the original grant, an agreement was reached between the State of New Jersey, Department of Education and Fairleigh Dickinson University which was approved by (USOE) Contracting Officer. This grant in the amount of $70,000.00 was later amended by the United States Office of Education adding $148,187 to Fairleigh Dickinson's sub-grant. The original grant was awarded for the

purpose of preparing Instructor Guides and Student Manuals with the necessary bibliographies. Awarding of the extension enabled the project staff and consultants to arrange for pilot and field testing in order to determine suitability and effect necessary revisions. Three tasks incorporated in the grant extension were the reproduction of materials, pre-pilot and pilot-testing, and evaluation of "the structure, content, processes and materials of the Project Materials."

During the summer of 1973, the need was felt for an additional product although not specifically mentioned in the contract grant. This was an exemplary section of the phase III (Exploration) Instructor's Guide, to illustrate one way in which the exploration of a particular segment of manufacturing might be explored. Food and Kindred Products (S.I.C. #20) was chosen as the exemplar, because some type of food producing industry would probably be found within a reasonable distance from almost any high school and also because it is among the easiest production areas to exemplify with minimal requirements for equipment and supplies. Pilot testing, including pre-pilot testing and product assessment/evaluation was a most significant part of the grant amendment. This part of the project required considerable care in the selection of sites and personnel to have appraisals which were objective and constructive. The pilot tests and their results will be delineated later in this report.

PART II

PURPOSE AND OBJECTIVES

The project "purposes and objectives" were set forth as follows by the Bureau of Adult, and Vocational Technical Education, United States Office of Education:

> The purpose of this Project is to develop a set of comprehensive curriculum guidelines for the Manufacturing Cluster that may be used to prepare high school students (9th, 10th, 11th, and 12th grade levels) to enter that field of occupation.
>
> The objectives of the study in the Manufacturing Occupational Cluster is to achieve an in depth occupational exploration and beginning specialization in one or more clusters for Phase III (grades 9 or 10). Also it will include opportunities for specialization in one job family of a cluster, and/or intensive skill training, both of which are for job entry purposes for Phase IV (grades 11-12 or 10-11).

After meetings in late 1971 between the project director, project coordinator, and USOE personnel, it was agreed that the original contract was not realistic in either scope or intent, and an amendement was requested. The changes were spelled out in the progress report of March 1, 1972, (Appendix A, pp. 11-12). References are made to the "Plan of Work", the "Scope of Work" and the general and specific objectives of each phase. Following these references, a set of specific tasks was set out for each phase on pp 11-14 of the report. These include the setting up of behavioral objectives for each phase.

Appendices to the report then specified the detailed plan of work for the preparation of each document called for by the original contract: Instructor Guides, Student Manuals, and appropriate bibliographies. The major thrust of the revision was not to change the purpose of the project but to limit the scope of the specific tasks to a more manageable, meaningful and educationally valid magnitude. The rationale and the model of "manufacturing", as well as a model of the curriculum development process, were part of the report. The March 1, 1972 progress report and recommendations were attached to the proposal for grant extension. The subsequent amendment adopted the objectives which are mentioned in the preceding paragraphs. Concept definitions for purposes of the project, are found on pp 4-5 of the report, (Appendix A).

PART III

OPERATIONS AND MANAGEMENT

A. ORGANIZATION AND MANAGEMENT

The organization chart (Appendix B) indicates the two parties involved, the New Jersey Department of Education, Vocational Division and Fairleigh Dickinson University. Fairleigh Dickinson's role was that of a sub-grantee of the New Jersey Department of Education. This was intended to add the dimension of higher education to the project to enhance the articulation from secondary to post-secondary schools.

The project staff was responsible for the "General and Specific Tasks for Phase IV" in the original grant and its subsequent extension. Certain tasks and functions delineated in the grant were deemed to be more appropriate to the sphere of influence of a major university. An agreement was negotiated between New Jersey Department of Education, Vocational Division, and Fairleigh Dickinson University. The relationship was much more involved than that of grantor/grantee. It was defined in the original agreement between the parties as:

> "a pilot project...to incorporate the education expertise of an institution of higher education with the capabilities of the New Jersey State Department of Education in a cooperative effort...As a result of this agreement, it is anticipated that a more meaningful and realistic study will evolve."

The Statement of Work in the agreement between Fairleigh Dickinson and the Department of Education (Appendix C), describes tasks assigned to the university, which were believed to be well within those "areas of expertise" mentioned in the previous paragraph. As might be anticipated, a large part of the university's role was embodied in the natural sphere of influence of a major institution, and its access to knowledgeable people both in and out of the institution's own staff. Consultants were therefore easier to locate and to retain. Many of these consultants were obtained by Fairleigh Dickinson at no cost to the project.

B. ADVISORY COMMITTEE

The first meeting of the project staff and the National Advisory and Review Committee (Appendix D) of this project was held in Washington, D.C. on July 13, 1973. The meeting took place in the conference room of the Department of Transportation, Federal Aviation Administration. A copy of the agenda is included (Appendix E). As is true with so many well-chosen committees, the most valuable information was frequently generated by the reactions of some of the participants to the statements of the speakers.

Dr. Melvin K. Strickler, Jr., Committee Chairman, defined the individual and collective roles of the Committee members. He explained that one role would be to review and evaluate the materials, drawing upon other available professional resources; while the other role, to act as a catalyst in increasing the interaction between industry and education. Dr. Strickler emphasized: "...Two words, advisory and review, are the key operational definitions. On the one hand, on the part of ourselves as professionals and/or our various constituencies that we represent, we should channel into the Project whatever constructive suggestions, criticisms, ideas, materials, that we feel are relevant in terms of the total goal within manufacturing."

It was suggested that the role of the Committee might be expanded to encompass more than the CAREER EDUCATION IN MANUFACTURING project. Dr. Strickler replied: "Bear in mind: we are advisory and review; and, we are advisory and review to the Project. They are the contractors. We are under the aegis of this Project; that is our function. However, that does not mean that we cannot give articulation, expansion or bridge building types of suggestions."

C. OPERATIONAL COMMITTEE

The Operational Committee for this project was constituted for the implementation of the purposes outlined in the agreement between the State Department of Education and Fairleigh Dickinson University, as previously described. Briefly, the committee consisted of representatives from Fairleigh Dickinson University, the Division of Vocational Education, and project staff. A list of committee members and their affiliations is attached. (Appendix F)

The first, of several meetings, was held on December 16, 1971 at Fairleigh Dickinson University. This was primarily an organizational meeting with a briefing on project purposes, objectives and work-in-progress. Considerable time was devoted to discussing the roles of project staff, the University, and the Vocational Division, as well as the project consultants who were proposed by staff. Certain on-going projects and industry-education councils were discussed. The proposed National Advisory and Review Committee was given some attention, and prospective members named. Each subsequent meeting consisted typically of a progress report and "State-of-the-Project" report, a budget review, and other routine items. There were also special items, such as the following:

- .Request for an extension of the grant from DHEW-OE
- .Introduction of a revised time-line chart
- .Discussion of possible pilot-test sites
- .Printing and publishing of project materials

D. INDUSTRIAL GROUP

At a very early stage in the project, it was recognized that the development of educationally sound curriculum for manufacturing education, would necessitate securing help in the area of content. It was necessary to limit the "Career Preparation" curriculum to the Quality Control and Inspection functions of industry as these were believed to be the most nearly product/process orientation of all manufacturing functions. In order to verify this, and to procure valid, up-to-date task analysis and job descriptions, industries, in all phases of manufacturing, were requested to supply the services of knowledgeable Quality Control personnel.

It was planned to bring these industrial representatives together for a two-day conference, which was held as planned, and which is covered later in this section. "Manufacturing" is so vast a descriptive term that it includes more than 80% of all the job listings in the Dictionary of Occupational Titles. The various product categories (Division D) listed in the Standard Industrial Classification Manual comprise twenty-one major groups. In order that all of the 21 major groups should be covered in our research and development, a list of the 1000 leading companies by dollar volume was obtained. This list was arranged by S.I.C. classification, so that it was a comparatively simple matter to make a request, by letter, telephone, or personal call, and to receive the services of knowledgeable people. More than 30 people agreed to assist us in our quest. A two-day conference was held on July 31 and August 1, 1972. A matrix showing the companies represented and the S.I.C. groups they cover is shown in Appendix G.

The result of this conference was a gratifyingly large amount of helpful material delineating in detail the skill and knowledge needed for various jobs in the quality control and inspection categories in a broad spectrum of manufacturing. This and other information was refined, sifted and rewritten. A subsequent meeting of selected participants was held at the Holiday Inn, Fort Lee, New Jersey, on December 18-19, 1972. At that time, participants received an outline for the curriculum which was prepared by our consultant, Mr. Harry Mottley, from the materials received from our industrial group. Input from the participants at the meeting, and later by mail, aided greatly in revisions and refinements. See Appendix H for the agenda of the two-day conference and a list of participants.

E. PROJECT STAFFING PATTERN

The original grant called for a staff consisting of a Project Director, an Associate Director plus one Researchist and an Office Manager with support staff. When the sub-grant was made to Fairleigh Dickinson University, the staff pattern changed to the form indicated on the organization chart shown in Appendix B.

The New Jersey Department of Education personnel included the Project Director, Researchist, Researchist (one year), and part-time services of a clerk-typist. (The latter was not included in the extension grant).

The sub-grantee, Fairleigh Dickinson University, agreed to provide the services of a Project Coordinator, Assistant to the Coordinator, editor and the necessary housing and supportive services.

The job descriptions indicate that duties and responsibilities of the project director and researchist, (Appendix I). The duties/ responsibilities of the Fairleigh Dickinson University personnel may be gleaned from the role of Fairleigh Dickinson University (Appendix C).

PART IV

PRODUCT CONCEPTUALIZATION AND DEVELOPMENT

In the original grant for this project the products were described as follows:

Phase III (Career Exploration)

1. Instructor's Guide
2. Student Manual

Phase IV (Career Preparation)

1. Instructor's Guide
2. Student Manual

The Instructor's Guide was conceived to differ from the Student's Manual since it would contain instructional materials appropriate for each of the common core job family groupings. This was to be based in Task #1:

> Identify and list the D.O.T. Occupational Titles, based on a job analysis, that relate to the revised cluster under the skill development and related knowledge column. This will result in a grouping of job families...

In his progress report dated March 1, 1972 (Appendix A), A.C. Buchanan, Project Director, pointed out that:

> "The amorphous nature of manufacturing precludes specificity of definition. In known contextual terms, "manufacturing" consists of eighty (80) percent of all production-type activities now on-going (and, internally, consisting of (approximately) 15,000 discrete jobs)..."

In the same report, it was further stated that:

> "The quality, intent, content and comprehensive requirements of the Grant provide limitations which are not compatible with the present knowledge-ladder upon which "Career Education" must be based.

This limitation of the scope of the project was coupled with the three Dimensional Matrix (Appendix A p.7). This taxonomy gave a new dimension to the project, its scope and function. It permitted a more detailed study, within newly-defined limits and parameters. It allowed for the integration of Industrial Arts and Vocational Education approaches to the problem, as well as for the exploration of "academic subject interrelationships within these selected categories and parameters." The concept of using food and kindred Product Phase III, Career Exploration, as an exemplar for the exploration of a given industry, comes somewhat later.

A significant change in concept, which resulted from the March 1, 1972 document, was the use of Quality Control and Inspection Occupations as the "Core Curriculum." Another change in concept was in the area of bibliography. It was found that there were so many and varied resources available, from all sources, that an ordinary "bibliography" would be too cumbersome for teachers to use. Instead, annotated, subject-classified resources were conceived for each phase.

PART V

PRODUCT DEVELOPMENT

The first detailed conceptualization of the various products of this project was delineated by A.C. Buchanan, Project Director, in the document attached to and part of the Progress Report, March 1, 1972 (Appendix A). In order to provide more work-relevant information, it was decided to learn from our industrial consultants whatever they might be able to tell us, not only in general sense, but in job-specific areas. It was recognized by project personnel that only industry could intelligently and efficiently provide answers to such questions as:

1. What does a person have to be able to do in order to fill the job of a _____(title in your industry)?

2. What does the person need to know in order to perform properly:

The basic concept here, then, was to use industry as our data-base in order to assure that we were to supply the most up-to-date and most realistic information to students and their teachers.

The industrial advisor group met with project personnel in August of 1972, and, after having been instructed in the writing of behavioral objectives and taught the use of the Dictionary of Occupation Titles, began sending in data sheets on specific jobs in their respective companies. These were used as a working base by our consultant on Quality Control and Inspection in drafting a "manufacturing core curriculum," based on quality control and inspection as a specific function. A subsequent meeting with our industrial advisor group provided the needed feedback for a revision of this curriculum, and its incorporation into the Phase IV (Career Preparation) Teachers Guide; other revisions, changes and additions were also made to Phase III and IV curricula as a result of the input from industry. The information gathered from all sources was assembled and fed to our consultant firm, B.M. & M. Associates, who assembled it and produced the first draft of the Phase III and Phase IV Instructor Guides.

This material was presented to our National Advisory and Review Committee in Washington, D.C. in August 1973. Feedback received at and subsequent to this meeting enabled us to rewrite and sound out the new draft for editing. The edited draft was printed and distributed to the committee members for further comments and suggestions. The consensus was that more detail was needed, in order to facilitate implementation in the classroom. Shortly after the National Advisory and Review Committee Meeting, work started on a newly-conceived part of Phase III, Career Exploration,

Instructor's Guide. In order to furnish a model for instructor's to follow in devising teaching strategies and working out of lesson plans, two representative sections from the Standard Industrial Classification Manual, under "Manufacturing" was selected, and developed by project staff members.

The group designated as major Group #21, "Food & Kindred Products" was developed as a detailed exemplar, including learning resources, and evaluation procedures for each sub-topic. This particular group was chosen as the one most likely to exist in even remote rural areas of the United States. It represented a shift in basic conceptualization, as the original curriculum development program tasks specified only Instructor Guides and Student Manuals. The Instructor Guides for Phase III, Career Exploration, and Phase IV, Career Preparation, were then submitted to the Office of Education, and were approved for pre-testing by Mr. William A. Dennis, Education Specialist, on October 19, 1973. It is sufficient to note here that pre-testing on Phase III, Career Preparation, was done by the Knox County, Tennessee School System. One of the consultants, Dr. Paul Gelles of San Diego, had already done considerable work in writing and field testing curricula in Quality Control and Inspection occupations. Dr. Gelles was asked to undertake the task of re-writing and pilot-testing Phase IV, Career Preparation in Manufacturing Occupations, which will be reported in detail under "Pilot Testing and Reviews." It is noted that Dr. Gelles was involved in two capacities: as a writer, and as the director of pilot-testing and revision activities.

PART VI

PRE-TEST & PILOT TESTING

A. INTRODUCTION

This section of the report is in two parts, as indicated in the title. The Pre-Test was done in Knox County, Tennessee, and the Pilot Test was done in San Diego, California. The materials used in the pre-test stage covered Phase III -- Career Exploration as approved for pre-testing by Mr. William Dennis, Educational Program Specialist, on October 19, 1973. The San Diego tests were run under the supervision of Dr. Paul Gelles, who also rewrote parts of both Phase III -- Career Exploration and Phase IV -- Career Preparation. His final report is attached.

It is useful to note here that the Pre-Test materials were also critiqued by members of our National Advisory & Review Committee, and by groups of teachers from various parts of the country. In the interest of brevity, these are not included herein, but are available for inspection. As indicated by Dr. Paul Gelles' introduction, Phase III -- Exploration was evaluated by a group of teachers there. The critiques by San Diego teachers are summarized in the Final Report.

B. PRE-TESTING

During the Fall semester, 1973, the materials for Career Exploration in Manufacturing were tested on a group of 17 students (nine male, eight female) in the Morristown East High School, in Knox County, Tennessee. Pre and Post tests were administered. Each contained cognitive questions, and a section on which students' reactions or opinions were requested. Analyses of these are attached in Appendix J. The opinion questions were worked so as to indicate any change in feeling after exposure to the materials. The higher percentage of correct answers to cognitive questions on the post-test is highly favorable. At the end of the test, the teacher completed a questionnaire which is appended to this report. A reading of her responses will show that the materials and the recommended resources were well received by both the students and the teacher.

C. PILOT TESTING

Dr. Paul Gelles submitted a detailed final report on his evaluation of the "Exploration" phase and pilot test (on both high school and junior college levels) and of the preparation phase of Career Education in Manufacturing. (Appendix K)

It is useful to refer to a part of Dr. Gelles' summary and recommendations where he reports that -

> "Generally, the Career Exploration and Career Education in Manufacturing are very necessary in preparing youth for the world-of-work."...and that is what the program was designed to do!

PART VII

RECOMMENDATIONS

The following recommendations were condensed and paraphrased from those submitted by consultants, pilot/field test sites, project personnel, and others. For convenience, they are listed by major category.

A. IMPLEMENTATION IN SCHOOLS

1. Career Education in Manufacturing should be incorporated at all levels of education in an effort to prepare students for the real world-of-work.

2. Exploration of the manufacturing occupations should be made at the junior high school level to influence student awareness of occupational potentials.

3. The exploration of industrial pursuits should begin at the seventh grade level and gradually be stressed to influence occupational choice prior to high school entry.

4. All efforts should be made to assist and encourage high schools to equip and encourage students to enter the world-of-work with realization that the majority of students will not enter college.

5. The occupational field of Inspection and Quality Control should be stressed since it is a contemporary emphasis and a major profession in the manufacturing industry.

6. The Career Preparation phase of Career Education in Manufacturing should be expanded and funded for a more meaningful study. Funding should be made to permit a minimum of one year of in-depth study at the senior high school level.

7. A pilot program of exploration should be extended for a longer period of time to be more meaningful and realistic. The exploration exemplar and associated materials should require at least one year of in-depth study.

8. High school administration should be encouraged and be made aware of the benefits and occupational potential of the manufacturing industries.

B. PUBLIC RELATIONS

1. The Career Education in Manufacturing programs should be publicized so that schools and manufacturing industries are made aware of the interests and efforts being made to assure job realizations for all interested students.

C. POST-SECONDARY PROGRAMS

1. Efforts should be made to incorporate and encourage junior colleges to participate in Career Education in Manufacturing Programs since it appears that students at these levels are more aware of the needs in the real world of manufacturing.

D. INSTRUCTOR IN-SERVICE TRAINING

1. Prior to implementing programs in manufacturing occupations in-service education and training programs for all participants is required.

2. The present career education program emphasis on "for the community" should be revisited. While it would seem to be true that the community will gain from such endeavors, it might well gain by infusion of personnel coming in exclusive of internal growth and development of its own residents. This factor is brought to mind when the mobility aspects of career education are addressed. The student populations will be exposed to mobility in pursuit of their careers, a social dimension not being considered adequately at this time.

E. EDUCATION-LABOR-INDUSTRY COOPERATION

1. An educational-industrial-labor marriage is a must if career education programs are to be accomplished effectively. The marriage must take place during the formative phases rather than late in the program.

2. A strong recommendation is made for a study to be performed concerning the feasibility and desirability of having industry/labor conduct some combination or phases of the technical-vocational segments of this type program. They have the resources and experience, and, on their own areas, conduct similar courses as a matter of standard operations.

F. EVALUATION

1. Continuing and serious study should be accomplished in the vague area of test, assessment and evaluation of programs. Most of the presently available inventories and criteria are post-informationally based. Human development is a future-oriented dimension. If criteria, tests, measurements, etc., are to be used, it would seem to necessitate the involvement of all parties concerned, and not the educational community alone. If, truly, the human development career dimension is being considered, it would appear more proper for the student to evaluate the program than vice versa.

PART VIII

REPRODUCTION AND DISSEMINATION

Following the assessment of comments by consultants, advisory committees, project staff, field tests, and review of Office of Education project staff the original manuscripts were edited and prepared for reproduction. The four titles are:

USGPO Stock #017-080-01657-5 Exploring Manufacturing Occupations - Students' Manual

USGPO Stock #017-080-01658-3 Exploring Manufacturing Occupations - Instructors' Guide

USGPO Stock #017-080-01655-9 Occupational Preparation - Inspection and Quality Control - Students' Manual

USGPO Stock #017-080-01656-7 Occupational Preparation - Inspection and Quality Control - Instructors' Guide

The Government Printing Office in New York City accepted the requisition for printing the four books. In addition the G.P.O. packaged the shipments and distributed the manuals in accordance with the dissemination plan supplied by the Project Officer, United States Office of Education. The GPO provided for the printing and dissemination of over 2200 manuals which were mailed in February, 1977 (Appendix L). In addition the Superintendent of Documents provided resources to ride the publication whereby additional copies of the documents are available for sale.

APPENDIX "A"

CAREER EDUCATION IN MANUFACTURING OCCUPATIONS

PROGRESS REPORT

Reporting Period - March 1, 1972

A. CAMERON BUCHANAN
Project Director
State of New Jersey
Department of Education
320 Orange Street
Newark, New Jersey 07104

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CAREER EDUCATION IN MANUFACTURING OCCUPATIONS

PROGRESS REPORT

I. GENERAL STATEMENT

The State of New Jersey Department of Education (Division of Technical-Vocational Education) herein submits a progress report concerning the Career Education in Manufacturing Occupations Project. This report deals with the rationale and subsequent formation activities, plan for project implementation and scope of work, in compliance with the terms and conditions of DHEW-OE Grant No. OEG-0-71-4687(357).

II. DEFINITIONS

The following nomenclature and definitions applicable to the Career Education in Manufacturing Occupations Project will be used as common denominators and bases for the structuring and content of the work performed under this Grant.

A. CAREER EDUCATION: An integrative multi-dimensional concept and framework comprised of all formal and informal educational experiences which occur during an individual's occupational career life cycle, including preparatory education for human and work purposes, learning activities occurring during his participation in the world of work, socialization factors, and education in and for recreation and retirement.

B. OCCUPATIONAL CAREER: A normal ordered developmental sequence extending over a (non-specific) period of years, during which an individual progresses through more responsible roles, inter/intra-occupation.

C. OCCUPATIONAL FAMILY:
FORMAL: A grouping of occupations having one or more similar parameters that facilitates formation of groups or families for purposes such as: job placement, transfer, selection, qualification, mobility, etc. Various methods of "family" classification can be derived such as: functional utility; level, field and industry; industry designations; etc.
INFORMAL: Families which are compared by other arrangements due to the idiosyncratic wants and needs of individuals, by selecting certain parameters, singly or in pairs, such as: by worker trait; seasonal occupations; part time; small vs. large industry; depression-proof jobs; defense occupations; etc.

D. OCCUPATION: The type or kind of work an individual does on a regular basis or schedule, usually performed for wages, salary, commission, or intangible income. The category "occupation" is comprised of groups of jobs and/or skills and abilities, (job families).

E. JOB FAMILY: A grouping of jobs having similar characteristics and/or parameters, such as: job performance, (normally related to people, data and things); general educational development; specific vocational preparation aptitudes; physical demands; etc.

F. JOB: A specific duty, role or function comprised of tasks, skills and abilities which enable performance at some defined or required level (job description).

III. RATIONALE

Career Education (herein defined) being a multi-dimensional integrative complex, is amenable to treatment and analysis by a systematic methodology. This framework provides an overview of the major elements of the structure and their interrelationships. Such a structure is depicted in figure 1, "Project Curriculum Development Plan", page 3.

The main purpose of the Career Education in Manufacturing Occupations Project is a curricula development program. As such, it will follow the format of the systematic model depicted in the "Curriculum Development Plan", figure 1, page 3. The general plan of work will be comprised of those delineated elements, their content and interfaces, as they are constrained by the scope and nature of work defined in Phases III and IV, and the time and money constraints inherent in the Grant, as follows:

ITEM	CONTENT
Develop Educational Goals and Identify Needs	The scope of work and delineated objectives pertinent to Phase III & IV of this project (as stated in the Scope of Work) constitute fulfillment of the inputs/outputs to these elements of the planning process.

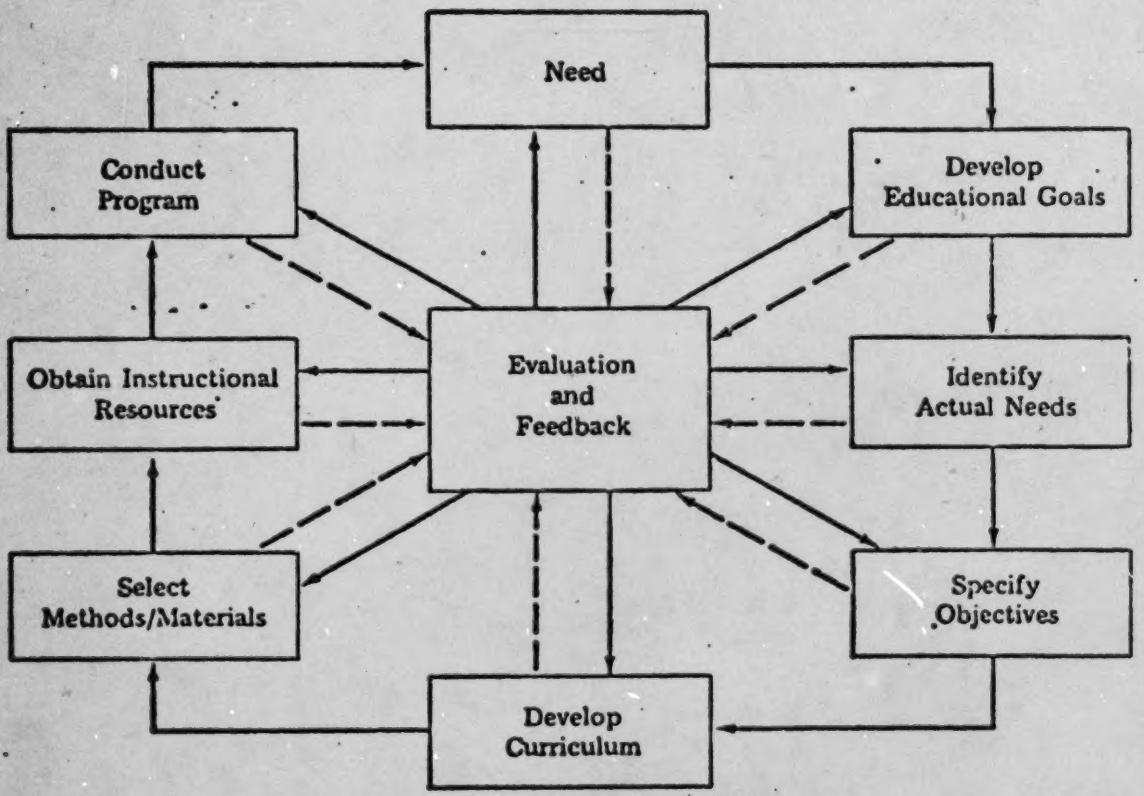
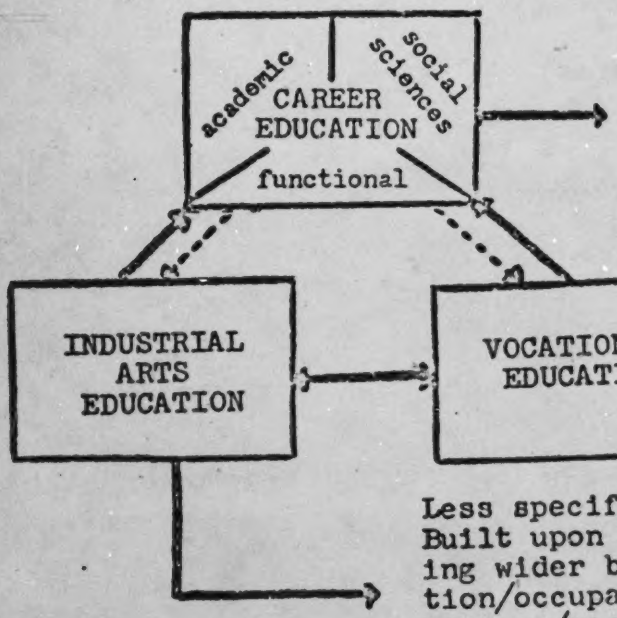


Figure 1. PROJECT CURRICULUM DEVELOPMENT PLAN

ITEM	CONTENT
Select Methods and Materials	Selection of Methods and Materials will be limited to recommending of proper and applicable state-of the-art materials and methods useful in and to this project in total, but not supplying other than those used in the specific designated academic-experiential program area developed.
Obtain Instructional Resources and Conduct Program	Not applicable to this Project.

The major concept embodied in Career Education is the integration, within the continuum of education, of the social purpose, organizational purpose, work purpose and human purpose "components" of the world of work/industry.

Inherent in the concept "Career Education" is the consideration of the fields of Industrial Arts and Vocational Education. This is evidenced by the inherent nature and content of each of these subject areas as is depicted by the diagram below.



Most general in content and structure. Integrates IA and Voc - Ed inputs/outputs with total academic, social science and functional parameters throughout the developmental epochs of a life cycle contained within occupational career/careers.

Most specifically oriented and structured at the job/occupation level.

Less specifically oriented and structured. Built upon Vocational Education but including wider band coverage directed at occupation/occupational career areas, plus work purpose/socialization content.

Primarily, Industrial Arts has formed a basic structure comprising that body of knowledge defined as Industrial Technology. This was an approach taken for the purpose of making an organized study of industry as a more treatable "whole".

Vocational Education is more "work" oriented and is specifically designed for the purpose of individual improvement in competency and performance relative to a point in time.

Unfortunately, both Industrial Arts and Vocational Education have been considered as esoteric and terminal by the schools, the students (and later as adults on the job), and by industry and labor. In very few instances have these subject areas been acknowledged and/or integrated within the standard paedometric schooling model.

This integration aspect is the overall goal of the term "Career Education". This project - Career Education in Manufacturing Occupations - is directed at integrated curriculum development of these technological and vocational aspects - a sub-set within the totality of Career Education.

PLAN OF WORK

The above definitions and rationale concerning Career Education formed the concept formulation and feasibility study phase of this project and have necessitated recognition of the following limitations and constraints that apply to this program:

1. A total Career Education in Manufacturing Occupations curricula development project is precluded by the direct constraints of time and monies available, when the concept and nature of Career Education is interpretated as delineated herein;

2. The amorphous nature of manufacturing precludes specificity of definition. In known contextual terms, "manufacturing" consists of eighty (80) per cent of all production-type activities now on-going (and, internally, consisting of (approximately) 15,000 discrete jobs); and

3. The quality, intent, content and comprehensiveness requirements of the Grant provide limitations which are not compatible with the present knowledge-ladder upon which "Career Education" must be (now) based.

Consideration of the limitations and constraints has caused the project to recognize its responsibility to develop a methodology and process that:

1. Delineates the functions of industry, the

basic common processes, and the industry classifications; and shows the interrelationships in a holistic frame;

2. Lends itself to specific treatment as a subset of the "whole" so that the educational content and process can proceed from the general to the specific (in-depth) and maintain interrelationship in total context; and

3. Lends itself to programmed building-block formulation, formation and development. This may be accomplished sequentially (ladder-concept), or by some partitioning method, to suit a given purpose, while still maintaining the common denominator modular formation, intent, content, quality, comprehensiveness and interfaces.

The taxonomy proposed by this project is shown in figure 2, page 7, and is comprised of a three-dimensional matrix showing the interrelationships of selected common basic processes of industry, versus industrial classification (by SIC codes), versus manufacturing industrial functions (typical).

This arrangement makes it possible to combine the knowledge of Industrial Arts (the technology based aspects) on a broad and interrelated sense in the three dimensions listed, with Vocational Education, per occupational family, per occupation, or per job. This will permit any degree of concept specificity within the designated occupation and job category, for parametric awareness, information, knowledge, and skills and abilities development.

Also, this framework allows for exploring academic subject interrelationships within these selected categories and parameters, enabling more pertinent curriculum development formation, speaking to the designated purpose - broad or specific.

It is the purpose of this project to utilize this model for designating and determing scope and content of work to be accomplished during Phases III and IV as specified in the section of this report entitled: Scope of Work.

The first section Phase III (A) of the work plan will be constituted to provide occupational information and awareness of the manufacturing industries classified (no. 19 through 39), constrained to speak to the basic processes (and pertinent sub-processes) delineated on the vertical axis, and, as both are interrelated to the manufacturing functions listed on the top of the three dimensional matrix, figure 2, page 7.

STANDARD INDUSTRIAL CLASSIFICATION MANUAL INDUSTRY DESCRIPTORS	
GROUP	DESCRIPTION OF INDUSTRY
19	Ordnance and accessories
20	Food and Kindred products
21	Tobacco manufactures
22	Textile mill products
23	Apparel and other finished fabric products
24	Lumber and wood products
25	Furniture and fixtures
26	Paper and allied products
27	Printing, publishing and allied industries
28	Chemicals and allied products
29	Petroleum refining and related industries
30	Rubber and miscellaneous plastics products
31	Leather and leather products
32	Stone, clay, glass and concrete products
33	Primary metal industries
34	Fabricated metal products, except 19, 35, 36, 37
35	Machinery except electrical
36	Electrical machinery
37	Transportation equipment
38	Professional, scientific and control instruments
39	Miscellaneous manufacturing industries

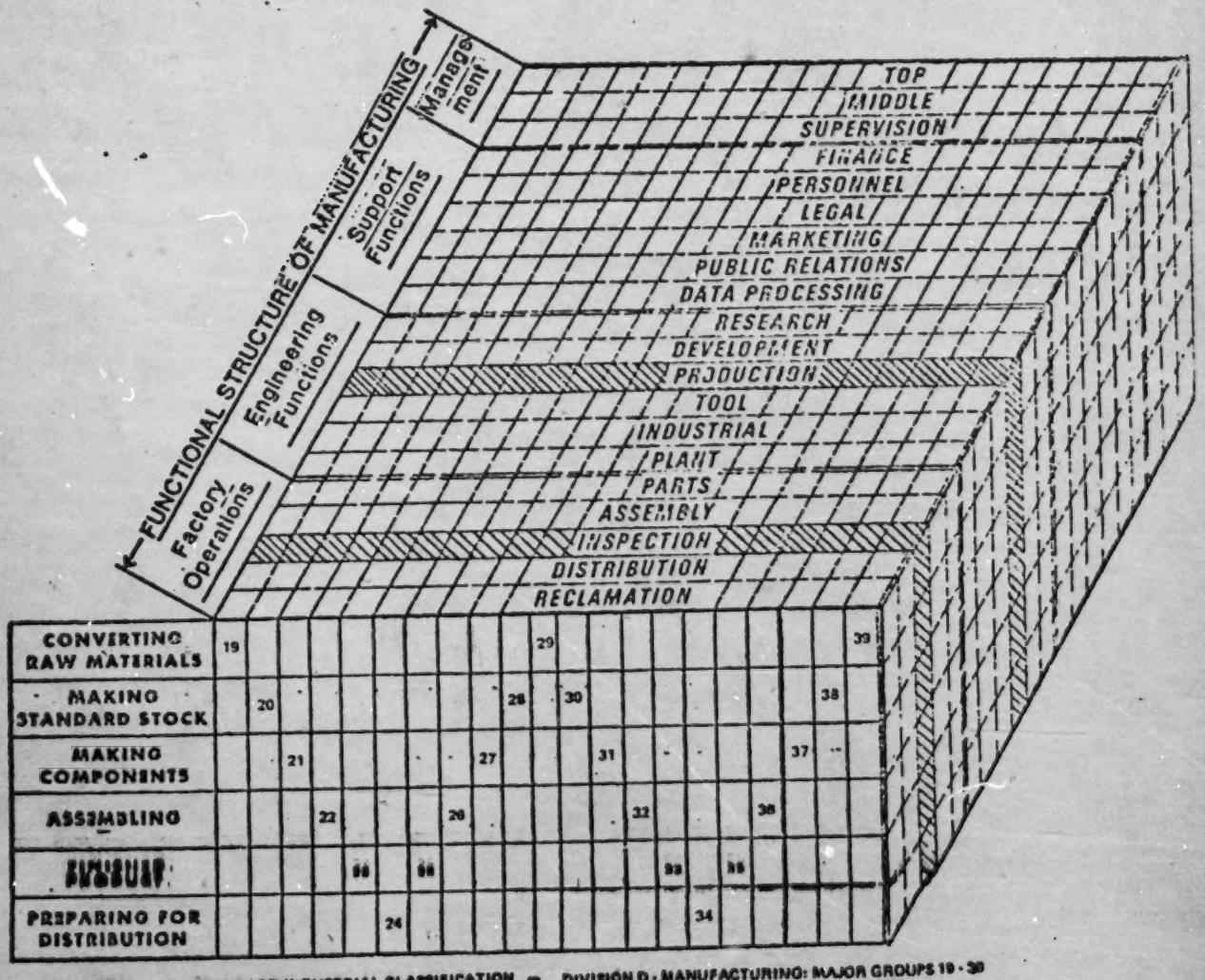


FIGURE 2. THREE DIMENSIONAL MATRIX

Illustrates the interrelationships of selected common basic processes of industry, vs. industrial classification (by SIC codes), vs. manufacturing industrial functions (typical).

The second section Phase III (B) of the work plan will be concerned with an academic-experiential program in beginning specialization in a pre-selected manufacturing functional area - namely, Quality Control and Inspection. This program will be used as an example of how the matrix components, (functions, processes and classifications) can be utilized as an integrating format for exploration and indepth study concerning categories of careers, occupations and jobs.

This exemplary academic-experiential specialization will be fully developed in the third section (Phase IV) to provide for intensive job-entry level skill acquisition and/or preparation for post-secondary or four year college education.

The actual formation of teacher guides and student resource manuals for phase III and IV will be accomplished by selected members of representative industries (i.e. Western Electric, General Electric, Boeing, Continental Can etc.) who are actually performing in the Quality Control and Inspection functions of industry. Each contributor will be constrained in content, form, and quality by the use of the typical formats for "Preparation of Teachers Guides" and "Preparation of Student Resource Manuals" and other standard formats published as herein appended to this section.

These formats have been constructed in an attempt to: have all inputs uniform in content, scope, quality, usefulness and applicability of information for an average Secondary School level; aid in construction of simulation training and experiences of a transferable nature when the real devices/machines are not obtainable; provide for a knowledge ladder which can be built upon existing relevant and applicable information; create specific levels of educational objectives and specific behavioral objectives which are content and performance standard oriented; provide a set of bases and reference materials that ensure adherence to acceptable terminology and theory relating to instruction and learning; aid in soliciting direct and other support by explicitly stating estimates of time/money/worth to the participating industries and personnel enhancing participation by them on a known contribution worth versus cost basis; and to minimize problems associated with printing/publishing.

SPECIFIC APPROACH

This specific approach is being implemented in three dimensions as follows:

1. Direct contact with the above listed industries (typical) for the use of their personnel and other necessary resources.

2. Direct contact with adjunct associations (typical ASWC, IEEE, ASME, AFL-CIO Trades,

NAM, ASTD, ASCD, AIAA, AVA, AGVA, etc.) for reasons of added influence and direct support, and as a larger resource for additional aid and services pertinent to curriculum development for the purposes of this project.

3. Direct contact with selected and pertinent University personnel and other consultants in the fields of: economics, sociology, psychology, physiology, occupational information and guidance, behavioral sciences, mathematics, language, information and curriculum development specialists, labor representatives, teachers and administrators - for the purposes of providing expert consultation in specific fields, integrating areas, methods and processes review and innovation, content completeness, pertinency and quality.

This plan of work will support the intent and content of the scope of work, at a quality level and comprehensiveness reflected by the embodied constraints.

Proceeding in this manner, the analysis, formulation and subsequent treatment of this designated area - as an exemplar of a method and process - provides a suitable framework for integrated and continuing treatment of the other aspects and elements of Manufacturing appearing in the matrix model. These follow-on curriculum development programs can be issued singularly or as a whole, at a future time, without loss of continuity due to the holistic nature of the methods and processes described in the plan of work.

SCOPE OF WORK

CURRICULUM DEVELOPMENT PROGRAM TASKS

The scope of work of the curriculum development program will deal with the following four (4) major tasks:

1. Review of the literature and present curriculum in order to assess whether or not the existing types of industrial arts and vocational curricula meet the present Secondary School goals of Career Education, including learning theory and instructional processes/methods.

2. Recommend, secure and/or develop Teacher training processes and materials so that they can make the courses of instruction more meaningful and real to their students.

3. Review and evaluate new curricula material for teachers and students for adoption and/or purchase by the school systems.

4. Develop new curricula materials for Teaching Guides and Student Resource Manuals in the designated manufacturing functions of Quality Control and Inspection.
These materials will be developed where none now exist that are pertinent to the selected areas concerned with Career Education in Manufacturing Occupations. Where pertinent materials do exist, these materials will be analyzed and/or up-graded to reflect newest state-of-the-art concepts, information and experiences.

CURRICULUM GENERAL PURPOSES

These curriculum development program tasks are directed at serving the general purposes of:

1. Providing for comprehensive overview of the general and specific areas of manufacturing occupations/careers permitting students to make more informed career/occupation/job choices.

2. Providing skill training appropriate to the selected occupation/occupational family area.

3. Providing sufficient skill knowledge and capability permitting student advancement to higher skill levels in the selected occupation/occupational family area.

4. Providing sufficient skill attainment enabling job placement upon completion of the Phase IV curricula in the selected occupation/occupational family area.

The broad career education objectives which are the focal point of the curriculum development program are:

BROAD CAREER OBJECTIVES FOR PHASE III

1. Provide for in-depth exploration and beginning specialization education and skills development training in the selected occupation family/job family.

2. Improve student performance in basic and related subject areas by focusing them around a career development theme.

3. Provide for occupational information and guidance functions in the selected occupational family as they interface with the

career education curricula regarding: intensive job preparation; post-secondary education option and/or preparation for college education.

BROAD CAREER OBJECTIVES FOR PHASE IV

1. Provide the student with intensive preparation in the chosen occupation/occupational family in preparation for job-entry and/or further education.

2. Improve student performance in his program by relating his studies to this chosen area of work.

3. Provide for occupational information and guidance functions as they interface with the career education curricula regarding intensive job preparation and/or further education.

4. Insure that the student meets the job entry, post-secondary and/or advanced educational pre-requisites of educational and skills parameters, as pertinent.

5. Provide a curriculum development program information function (feed-back-loop) which can be utilized to evaluate the designated applicable program factors*, implement changes and assess corrective action in and during curricula development and subsequent usage.

NOTE:* The curriculum development tasks will be performed for each of the pertinent elements delineated on figure 1, "Project Curriculum Development Plan" (see page 3), namely: (a) Specify Objectives; (b) Develop Curriculum; and (c) Select Methods/Materials.

The four (4) curriculum development program tasks will be exercised as the criteria for formation and determination compliance of the Phase III (grade 9 or 10) and Phase IV (grades 11 and 12) tasks listed below:

SPECIFIC PHASE III TASKS

1. Determine tentative outline of common core content for Teachers Guide.

2. Determine tentative outline of content for Student Resource Manual.

3. Determine behavioral objectives.

4. Submit five (5) copies each of items 1 and 2 to OE Project Officer, and one (1) copy each to

to the project consultants.

5. Hold a one day meeting in Washington, D. C. with project consultants and DVTE staff members two weeks after submitting items 1 and 2 for purposes of review, planning and direction.

6. Revise items 1 and 2 based on meeting in item 5.

7. Develop Teachers Guide and Student Resource Manual.

8. Submit five (5) draft copies of Teachers Guide and Student Resource Manual to OE Project Officer and one (1) copy each to project consultants.

9. Hold a two day meeting in Washington, D. C. with consultants and DVTE staff members for review of the Teachers Guide and Student Resource Manual after submitting items specified in item 3 above.

10. Revise Teachers Guide and Student Resource Manual based on suggestions resulting from the meeting listed in item 9.

SCHEDULE OF TASKS TO BE PERFORMED FOR PHASE III

ITEM 1.....MAY 1972	ITEM 6.....JUNE 1972
ITEM 2.....MAY 1972	ITEM 7.....OCT. 1972
ITEM 3.....MAY 1972	ITEM 8.....OCT. 1972
ITEM 4.....MAY 1972	ITEM 9.....OCT/NOV. 1972
ITEM 5.....MAY/JUNE 1972	ITEM 10.....FEB. 1973

SPECIFIC PHASE IV TASKS

1. Identify and delineate the SIC/DOT industrial occupations, occupational and job families and parameters of the selected areas specified under "Plan of Work" (Quality Control and Inspection

2. Identify and categorize the skills, abilities and knowledge of the occupational and job families of those selected areas specified under "Plan of Work" (Quality Control and Inspection).

3. Develop and delineate behavioral objectives for

the occupational/job families established in items 1 and 2.

4. Review, evaluate, recommend, secure and/or develop for the Teachers Guide, instructional materials appropriate for each of the occupation/job families developed in item 1.

5. Develop an outline for a Teachers Guide and Student Resource Manual.

6. Submit five (5) copies each of both outlines as per item 4 under Phase III Tasks.

7. Same as Item 5, Phase III.

8. Same as Item 6, Phase III.

9. Same as Item 7, Phase III.

10. Same as Item 8, Phase III.

11. Same as Item 9, Phase III.

12. Same as Item 10, Phase III.

SCHEDULE OF TASKS TO BE PERFORMED FOR PHASE IV

ITEM 1.....MAY 1972	ITEM 7.....MAY/JUNE 1972
ITEM 2.....MAY 1972	ITEM 8.....JUNE 1972
ITEM 3.....MAY 1972	ITEM 9.....OCT. 1972
ITEM 4.....MAY 1972	ITEM 10.....OCT. 1972
ITEM 5.....MAY 1972	ITEM 11.....OCT/NOV. 1972
ITEM 6.....MAY 1972	ITEM 12.....FEB. 1973

COMBINED TASKS FOR PHASE III AND PHASE IV

1. Upon approval of all publications by OE Project Officer, publish materials.

2. Disseminate publications as determined by OE Project Officer in Item 1.

3. Provide twenty-five (25) copies of all publications to OE Project Officer and one (1) each to the Contracts and Grants Officer, along with the required reproduceables and negatives.

SCHEDULE OF COMBINED TASKS FOR PHASE III AND PHASE IV

ITEM 1.....	MARCH 1973
ITEM 2.....	MARCH 1973
ITEM 3.....	MARCH 1973

APPENDIX A

PREPARATION OF TEACHER GUIDE

PREPARATION OF TEACHER GUIDE

NOTE: This proposed Guide is currently being reviewed and evaluated for pertinency. It is included as representative of what will be a format for use in curricula development activities.

TITLE - Subject Matter/Area

LEARNING ACTIVITY (General)

Concepts - Specific to General

LEARNING OBJECTIVES

Cognitive, Psychomotor, Affective Domain

TEACHING ACTIVITIES

Schedule - process and content formulation

Materials - supplies, equipment

Overview - Introduction and Relationships

Presentation - Expansion and Clarification

Discussion - Feedback and Reenforcement

Laboratory - academic-experiential Activities

Evaluation - Assessing Achievement

Summary - Recapitulation

Next Assignment - Homework

APPENDIX B

PREPARATION OF STUDENT RESOURCE MANUAL

PREPARATION OF STUDENT RESOURCE MANUAL

NOTE: This proposed Guide is currently being reviewed and evaluated for pertinency. It is included as representative of what will be a format for use in curricula development activities.

TITLE - Subject Matter/Area

LEARNING ACTIVITY (General)

Concepts - Specific to General

LEARNING OBJECTIVES

Cognitive, Psychomotor, Affective Domains

LEARNING ACTIVITY (Specific)

Learning Resources - Adaptation to fit Subject Matter and Student

SELF-ASSESSMENT

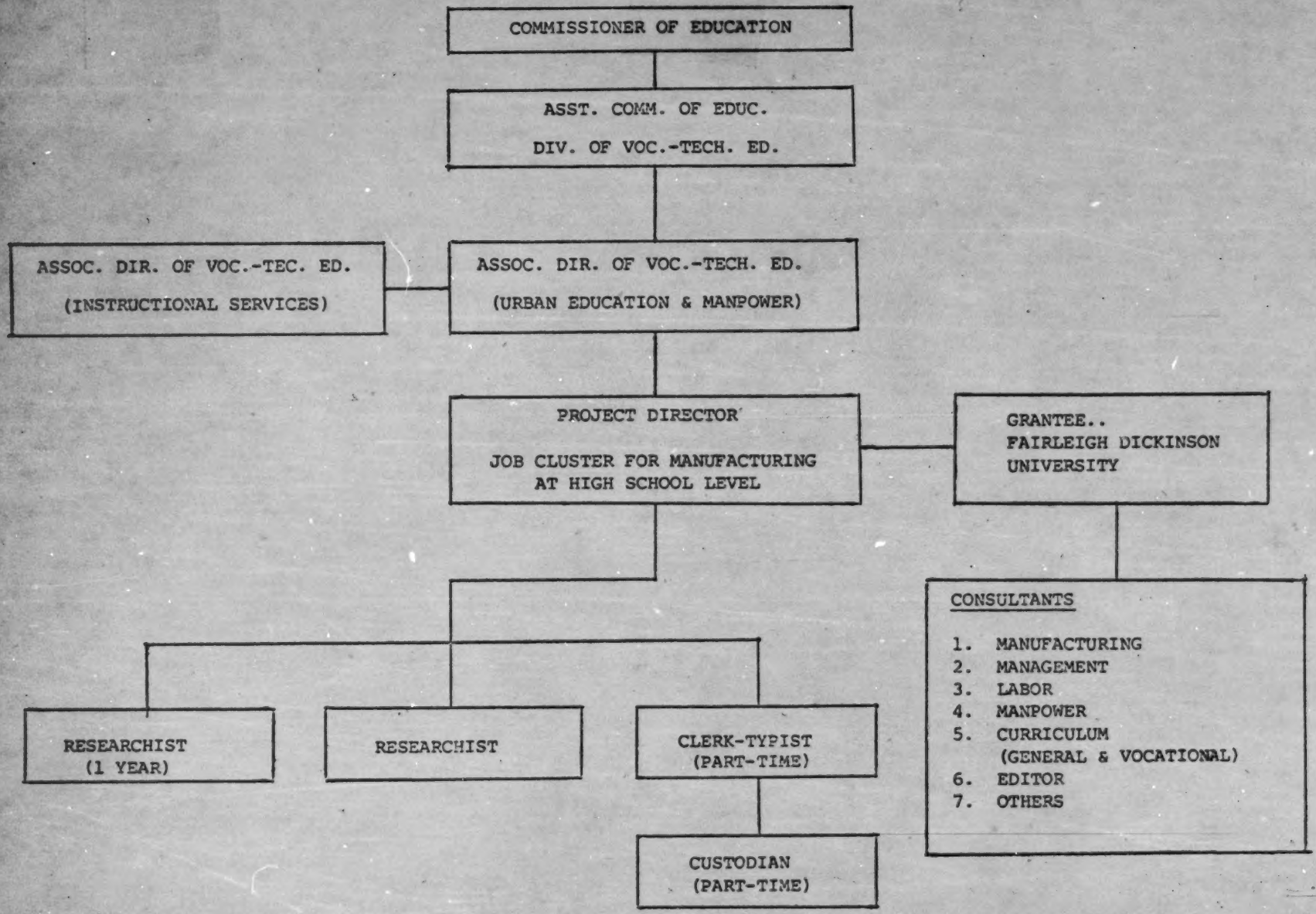
Indicator of Achieved Behavior

SUMMARY - Recapitulation/Reenforcement

NEXT ASSIGNMENT

ORGANIZATION CHART

JOB CLUSTER FOR MANUFACTURING AT THE HIGH SCHOOL LEVEL



ROLE OF FAIRLEIGH DICKINSON UNIVERSITY

APPENDIX C

The University will provide:

1. Consultants from manufacturing, industry, education, labor and other organizations. This will be done in cooperation with the Project Director on the State Staff.

2. Obtain the services of programmers and other necessary EDP personnel.

3. Arrange with private industry for the loan of key personnel in such areas as manpower training and development, economics, and labor.

4. Assist the Project Staff and consultants in the over-all planning of the activities relevant to the study, organization, composition, editing, printing, and dissemination of the Teachers Guides, Student Manuals, and/or programmed materials, suggested supporting teaching aids and other materials required by the Grant.

5. Coordinate its efforts through visitations of its staff to experimental and/or pilot programs related to the development program, including the Cluster Projects in Texas, California, Oregon, and Ohio in addition to the required meetings in Washington, D.C.

6. In conjunction with the Project Director, select advisors from various manufacturing, industrial, educational, labor, management, and other disciplines which might give direction to the development of the project.

7. Submit all reports and documents as required by the conditions of the Grant to the State Project Director.

8. Retain consultants from:

   a. Manufacturing
   b. Labor
   c. Industry
   d. Education
   e. Management
   f. Manpower Development and Training
   g. Others (See attached Proposal, Page 10, Item A.1.d.)

   In all of the above categories, it is anticipated that the services of the consultants will be required for approximately fifteen to thirty days. Examples of the caliber of consultants

that might be used would include: Dr. William Wolansky, State University of Iowa; Dr. Donald Maley, University of Maryland; Dr. Delmar Olson, North Carolina University; Dr. Gerald Whitlock, University of Tennessee; Dr. Al Kruppa, Trenton State College, Trenton, New Jersey.

9. Assure that proper coordination of all phases is achieved toward the successful completion of this total project by the retention of appropriate personnel.

APPENDIX D

NATIONAL ADVISORY & REVIEW COMMITTEE

ON

CAREER EDUCATION IN MANUFACTURING

DR. MERVIN K. STRICKLER, JR., Chairman
Chief, Aviation Education Programs
Office of General Aviation Room 1021
Department of Transportation
Federal Aviation Administration
800 Independence Avenue, S.W.
Washington, D.C. 20951
(202) 426-3711

DR. BERTIS E. CAPEHART
Director, Education Department
American Iron & Steel Institute
1000 16th Street, N.W.
Washington, D.C. 20036

(202) 223-9040

DR. OLIN L. ADAMS, JR.
Superintendent
Warren Consolidated Schools
29900 Lorraine Boulevard
Warren, Michigan 48903

(313) 751-1100

MR. JOHN A. SESSIONS
Assistant Director
Department of Education
AFL-CIO
815 16th Street, N.W.
Washington, D.C. 20006

(202) 637-5000

MR. JERRY D. BROOKS
Manager
Educational Services
United States Steel Corp.
600 Grant Street
Pittsburgh, Pa. 15203

(412) 433-6901

DR. WILLIS E. RAY
Professor of Industrial Arts
The Ohio State University
Industrial Technology Education
190 West 19th Avenue
Columbus, Ohio 43210

(614) 422-7471

MR. KENNETH KUBICKI
Department Chief
Community Relations
Western Electric Co.
100 Central Avenue
Kearny, New Jersey 07032

(201) 344-7700

MR. GEORGE R. QUARLES
Chief Administrator
Office of Career Education
Board of Education
The City of New York
1100 Livingston Street
Brooklyn, New York 11201

(212) 522-5122

MR. LEE HAMILTON
Executive Secretary
National Association of
Manufacturers
277 Park Avenue
New York, New York

(212) 826-2100

NATIONAL ADVISORY & REVIEW COMMITTEE

MR. DONALD RATHBUN
Associate Director of
Research & Studies
American Vocational Association
1510 H Street, N.W.
Washington, D.C. 20005

(202) 737-3722

MR. LARRY JOHNSON
Executive Director
Vocational Industrial Clubs
of America
105 Virginia Avenue
Falls Church, Virginia

(703) 533-2090

DR. DONALD MALEY
Professor of Industrial
Engineering
University of Maryland
College Park, Maryland

(301) 454-4791

MR. LAWRENCE DAVENPORT
Vice President for
Development
Tuskegee Institute
Tuskegee, Alabama 36088

(205) 727-5198

DR. KENNETH G. SKAGGS
Specialist in Occupational
Education
American Association of Community
and Junior Colleges
One Dupont Circle, N.W., Suite 410
Washington, D.C. 20036

(202) 293-7050

MR. WALTER ZAHAREVITZ
Executive Director
National Aerospace Education
Association
806 15th Street, N.W.
Washington, D.C. 20005

(202) 628-7400

DR. RAY WAHL
Chief, Course Development Branch
Office of Training & Education
Occupational Safety & Health
Administration
U.S. Department of Labor
Room 401, Railway Labor Building
400 First Street, N.W.
Washington, D.C. 20210

(202) 961-3255

DR. EDWARD KABAKJIAN
Executive Secretary
American Industrial Arts
Association
1202 16th Street, N.W.
Washington, D.C. 20036

(202) 833-4211

PARTICIPANTS AND OBSERVERS

SYDNEY P. MARLAND, JR.
Assistant Secretary for Education
Department of Health Education & Welfare
U.S. Office of Education
ROB 3
7th and D Streets, S.W.
Washington, D.C. 20202

ROBERT M. WORTHINGTON
Associate U.S. Commissioner of Education
Center for Adult, Vocational, Technical and Manpower Education
Department of Health, Education & Welfare
ROB 3
7th and D Streets, S.W.
Washington, D.C. 20202

BERNARD MICHAELS
Executive Director
Federal Interagency Committee on Education (FICE)
U.S. Office of Education
ROB 3
7th and D Streets, S.W.
Washington, D.C. 20202

ELIZABETH SIMPSON
Director, Curriculum Center for Occupational & Adult Education
U.S. Office of Education
ROB 3
7th and D Streets, S.W.
Washington, D.C. 20202

VIRGINIA J. CROFT
Director, Public Information
Vocational Industrial Clubs of America
105 North Virginia Avenue
Falls Church, Virginia 22046

EDWIN T. PETRIE
Project Director
Transportation Career Education Curriculum Project
Ohio Division of Vocational Education
85 Gay Street, Suite #708
Columbus, Ohio 43215

DAVID GOODMAN
CEDTF-NIE
Code 600
Room 612
Washington, D.C. 20202

CECILY LEE
CEDTF-NIE
Code 600
Room 612
Washington, D.C. 20202

FRED PELZMAN
APA - 8
office of Public Affairs
Federal Aviation Administration
Washington, D.C. 20951

KENNETH E. YOUNG
Vice President
American College Testing Program
One Dupont Circle, N.W.
Washington, D.C. 20036

SHERRILL D. MCMILLEN
Chief State Programs and Service Branch
Division of Vocational/ Technical Education
U.S. Office of Education
Washington, D.C. 20202

OLIVER LAINE
Education Specialist
Office of General Aviation
Department of Transportation
Federal Aviation Administration
800 Independence Avenue, S.W.
Washington, D.C. 20591

STORY MOOREFIELD
Office of Public Affairs
DHEW - OE
ROB 3
7th and D Streets, S.W.
Washington, D.C. 20202

ORIEANNA C. SYPHA
Secretary to Sub-Committee
Federal Interagency Committee on Education (FICE)
Department of Health, Education & Welfare
Office of Education, ROB 3
7th and D Streets, S.W.
Washington, D.C. 20202

STAFF MEMBERS

Mr. A. Cameron Buchanan
Project Director
320 Orange Street
Newark, New Jersey 07103
(201) 648-2174

Dr. Charles R. Moffett
Project Coordinator
Office of Doctoral Studies
Fairleigh Dickinson University
Teaneck, New Jersey 07666
(201) 836-6300 Ext. 491

Mr. Richard Chalfont
Project Researchist
320 Orange Street
Newark, New Jersey 07103
(201) 648-2174

Mrs. Nancy C. Dillenberg
Office Manager-Administrative
Assistant
Office of Doctoral Studies
Fairleigh Dickinson University
Teaneck, New Jersey 07666
(201) 836-6300 Ext. 492

THE MEETING OF THE

NATIONAL ADVISORY AND REVIEW COMMITTEE

ON

CAREER EDUCATION IN MANUFACTURING

A

U.S. OFFICE OF EDUCATION
NEW JERSEY STATE DEPARTMENT OF EDUCATION
FAIRLEIGH DICKINSON UNIVERSITY
PROJECT

A G E N D A

10:00 A.M.	INTRODUCTIONS - Dr. Charles R. Moffett Project Coordinator
10:10 A.M.	ROLE OF THE NATIONAL COMMITTEE ON CAREER EDUCATION IN MANUFACTURING - Dr. Melvin K. Strickler, Jr., Chairman
10:30 A.M.	CAREER EDUCATION - Dr. William F. Pierce Deputy Commissioner for Occupational & Adult Education
11:00 A.M.	A MODEL FOR CAREER EDUCATION IN MANUFACTURING Mr. A. Cameron Buchanan Project Director
12:00 P.M.	LUNCH - (FAA Executive Dining Room) with Dr. Sidney P. Marland, Jr. Assistant Secretary for Education
1:30 P.M.	PROGRESS REPORT AND PLANS FOR PILOT-TESTING OF TEACHER'S GUIDES AND STUDENT RESOURCE MATERIALS - Project Staff
2:30 P.M.	PLANS FOR NATIONAL WORKSHOP - Staff & Committee
3:00 P.M.	ADJOURNMENT

* * * *

Date: FRIDAY, JULY 13, 1973

Time: 10:00 A.M. - 3:00 P.M.

Place: Ninth Floor, Conference Room 9 A&B
Department of Transportation
Federal Aviation Administration
800 Independence Avenue, S.W.
Washington, D.C. 20951

APPENDIX F

OPERATIONAL COMMITTEE

BETWEEN

THE NEW JERSEY DEPARTMENT OF EDUCATION

AND

FAIRLEIGH DICKINSON UNIVERSITY

NEW JERSEY DEPARTMENT OF EDUCATION

Mr. John E. Radvany

Mr. Stephen Poliacik

Mr. A. Cameron Buchanan

FAIRLEIGH DICKINSON UNIVERSITY

Dr. Charles R. Kelley

Dr. Donald Herdman

Dr. Richard Touma

Dr. Charles R. Moffett

APPENDIX G

PRODUCT CATEGORY BY INDUSTRY MATRIX*

	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39
American Machine & Foundry (AMF)					X												X		X		X
[illegible]	X													X			X	X	X		X
[illegible]on-Dickinson																X		X		X	
Burlington Industries				X	X																
Celanese				X		X				X		X									
Conwood Corp.		X	X							X											
Continental Can Co.								X						X		X					
Continental Oil Co. Inc.										X	X										
Food Machinery Corps. (FMC)	X									X					X	X	X		X		
Garlock Inc.												X	X	X				X			
General Motors																	X	X	X		
Georgia Pacific Corp.						X	X	X													
B. F. Goodrich Co.					X					X		X							X	X	
Gulf Oil Corp.												X									
Humble Oil Co.												X									
Lever Bros.		X								X											X
Lockheed	X																	X	X		
[illegible] Industries										X					X		X				
[illegible]ort News & Shipbuild.										X							X		X		
North American Rockwell	X															X		X	X		
Northrop																		X	X	X	
Potlach Forests Inc.					X	X		X													
Republic Steel Corp.															X	X					
Reynolds Metals Co.															X	X					
Ronson Corp.																		X	X		X
St. Regis Paper Corp.						X		X													
Samsonite Corp.							X						X								
Sherwin Williams Co.		X								X						X					X
U. S. Tobacco		X	X																		X
United States Shoe Corp.													X								
United States Steel															X	X	X				
Uniroyal				X						X		X									
Villager Industries					X																
Vulcan Materials Co. Inc.										X				X	X						
[illegible]ern Publishing Co.									X												
[illegible]nghouse Electric															X		X	X	X		
Weyerhauser Co.						X		X													
Xerox						-			X								X			X	

* Compatible with S.I.C. Industrial Manufacturing Code, Divison D.

CONFERENCE ON CAREER EDUCATION IN MANUFACTURING

FAIRLEIGH DICKINSON UNIVERSITY

TEANECK, NEW JERSEY

Monday - July 31, 1972

9:00 - 9:30 A.M.	Introductory Remarks - Representatives of: DHEW - Office of Education Fairleigh Dickinson University New Jersey State Department of Education
9:30 - 10:00 A.M.	Orientation to Career Education Film and Remarks
10:00 A.M.	Coffee
10:30 - 12:00 A.M.	Rationale, Concepts and Structure of Career Education in Manufacturing Discussion period
12:00 A.M.	Lunch
1:30 - 2:30 P.M.	Continuation of discussion period
2:30 - 4:30 P.M.	U.S. Department of Labor - Typology and Structure of Careers, Occupations, and Jobs in Manufacturing Industries

Tuesday - August 1, 1972

9:00 - 10:00 A.M.	Overview and Introduction to Career Education Curricula Development Parameters
10:00 A.M.	Coffee
10:30 - 12:00 A.M.	Curriculum Development Lecture and Demonstration: Typical Content and Processes
12:00 A.M.	Lunch
1:30 - 3:00 P.M.	Curriculum Development Workshop
3:00 P.M.	Critique and Review

MASTER CONFERENCE LIST

FULLER, Dr. J. Osborn (F.D.U.)

HERDMAN, Dean Donald (F.D.U.)

KELLEY, Dr. Charles Robert (F.D.U.)

HOGBIN, Mr. William O. (DHEW-OE)

RADVANY, Mr. John E. (N.J. State Dept. of Education)

BUCHANAN, A. Cameron

DILLENBERG, Nancy C.

MOFFETT, Charles R.

CHALFONT, Richard

WILSON, Pamela

BROOKS, Mr. Jerry D.
(U.S. Steel)

BUCHANAN, Catherine
(N.J. State Training and Employment)

BUONTEMPO, Mr. Gregory
(N.J. State Dept. Educ.)

CALLELO, Mr. Nicholas
(Amer. Bible)

COLLINS, Mr. William
(Dart Ind.)

CRAWFORD, Mr. Alfred
(Humble Oil)

DOHERTY, Mr. Patrick
(N.J. State Dept. Educ.)

ERNST, Mr. Frederick H.
(Amerada-Hess)

GOLDSTEIN, Mr. Chuck
(National Distillers)

GOSSELIN, Mr. Robert A.
(Tupperware)

GREENE, Mr. Fred
(Humble Oil)

GROSS, Mr. Melvin
(Sherwin-Williams)

HAMILTON, Mr. Lee
(N.A.M.)

HAVLINA, Mr. L.J.
(Quinn-Boden)

HEID, Mr. Jack C.
(G.A.F.)

HICKERSON, Mr. R.J.
(Reynolds Metals)

HORVATH, Mr. Robert
(Elec. Assoc. Inc.)

HUMAK, Mr. Walter
(Western Electric)

HUNT, Mr. J.V.
(Westinghouse)

IVERSON, Mr. Jack
(N.J. State Training
and Employment)

KRYGAR, Mr. Paul
(N.J. State Dept. Educ.)

KUBICKI, Mr. Kenneth
(Western Electric)

LOSEE, Mr. Charles H.
(Becton Dickinson)

LUMI, Mr. Jaan
(National Distillers)

LYONS, Dr. Kenneth C.
(Nat'l. Bur. of Stand.)

MALOVANY, Mr. Seymour
(Clark Equip.)

MANGANO, Mr. Vincent J.
(Maxwell House)

MARCUS, Mr. Alan
(Cummins Engine)

MARKOWITZ, Mr. Joel
(Dart Industries)

MURPHY, Mr. Donald
(Amerada-Hess)

PETERSON, Prof. Cecil R.
(General Motors)

RICHARDS, Captain Bruce
(U.S. Army)

RISDEN, Mr. Robert J.
(A B Dick Co.)

ROBERTS, Dr. Luther L.
(G.A.F.)

ROBINSON, Mr. Jack
(No. Carolina - Dept.
of Public Instruction)

ROSSER, Dr. Arthur
(Montclair State)

SAIF, Dr. Phillip
(F.D.U.)

SPARKS, Mr. Thomas
(Philco-Ford)

TASKALOS, Mr. James N.
(Maxwell House)

THOMPSON, Mr. Carroll G.
(R.J. Reynolds)

WALSH, Mr. Al
(Signalite)

WIPER, Dr. Robert
(A B Dick)

WHITNEY, Mr. Stanton
(Litton Publ.)

WHITSON, Mr. Jerry
(Samonsite)

JOB DESCRIPTION

FOR

RESEARCHIST

Project: Job Guides for Manufacturing at the High School Level.

Under the supervision of the Associate Director, the Researchist will seek, analyze and interpret information to be used in the project, using all available resources. He will then communicate this information to the Associate Director in the most readily usable form, either written or verbal. The Researcher's duties, responsibilities, and authority are:

1. Consult all conventional sources of information, such as public and university libraries, the Resource Center at Edison, and other such collections, traveling as necessary.

2. Seek and cultivate personal contacts among members of the academic and manufacturing communities as a means of developing information resource people. Maintain an active file of these persons and their areas of interest and input.

3. Assist in the selection and organization of advisory committees from among labor, management, manpower, and manufacturing. Prepare questionnaires to be submitted to these groups and individuals.

4. Follow up the questionnaires with personal interviews or telephone contacts in order to procure more complete and candid answers than a letter might provide. Travel as necessary.

5. Supervise the date processing of statistics gathered from the above sources and from questionnaires submitted to the general membership of professional organizations in the areas mentioned in 3, above.

6. Analyze and report to Associate Director on the statistical information received from the data processing service.

7. Act as liaison between the Associate Director and members of the Advisory Committees.

8. Write research reports for the use of the Associate Director. Assist him in curriculum writing as needed.

9. Index and maintain files of source documents, books, and information sources.

10. Disseminate progress reports to advisory committee members and other concerned individuals.

Requirements: B.A., plus 5 years experience in education to include teaching experience, research and curriculum development.

JOB DESCRIPTION

FOR

PROJECT DIRECTOR

Project: Job Cluster for Manufacturing at the High School Level

1. The Director will organize and administer the research project in keeping with the contract/grant Proposal for Curriculum Development Program in Vocational and Technical Education, entitled "Job Cluster for Manufacturing at the High School Level", dated June 22, 1971, and effective June 30, 1971. (Copy attached). This contract/grant is between the U.S. Office of Education, Division of Vocational and Technical Education, and the State Department of Education, Division of Vocational Education. Accountability and reportability are inherent in the contractual agreement. In addition, the Director will report periodically (at least quarterly) to the Associate Director of Vocational-Technical Education (Urban Education and Manpower Training) and the Associate State Director of Vocational Technical Education (Instructional Services). This report will indicate the progress of the time table as required in the contract/grant.

2. The Director will plan, organize, coordinate, control, and motivate the research and dvelopment project ("Job Cluster for Manufacturing at the High School Level") being couducted for the U.S. Office of Education, Division of Vocational-Technical Education, by the State Department of Education New Jersey, Division of Vocational Education.

3. The Director will select, interview, and recommend the hiring of personnel (Professional, clerical, consultants, and custodial) to the Associate Director of Vocational-Technical Education (Urban Education and Manpower Training) and the Associate State Director of Vocational-Technical Education (Instructional Services). The general and specific duties of each member of the research staff will be mutually planned and agreed upon by the Director and the team members.

4. The Director will supervise and coordinate the research team so as to fulfill the intent of the contract/grant. To accomplish this, he will regulate the work flow and arrange the work loads. He will be responsible for all fiscal and administrative decisions in said contract/grant.

5. The Director will maintain the proper records, information, and reports necessary in complying with the State Regulations regarding payroll, attendance, expenditures (travel, purchasing, etc.).

6. The Director, upon completion of the project, will assure the publication and distribution of the products of the research and will complete all final reports and close out the project.

APPENDIX J

JOB CLUSTER FOR MANUFACTURING OCCUPATIONS

AT THE HIGH SCHOOL LEVEL

KNOXVILLE, KENTUCKY

PRE-PILOT TEST

"COGNITIVE" QUESTIONS

	PRE-TEST		POST-TEST	
#	CORRECT	INCORRECT	CORRECT	INCORRECT
1	17	0	15	2
2	17	0	17	0
3	6	11	14	3
4	7	10	1	16*
5	5	12	15	2
6	12	5	17	0
7	10	7	17	0
8	9	8	17	0
TOTALS	83	53	113	23
PERCENTAGES	61%	39%	83%	17%

N=17 Total answers 17 x 18 = 136 possible answers

*NOTE:

This is the only item which a majority of students answered incorrectly. It seems to indicate that there is a weakness in either the materials themselves, or the presentation.

ANALYSIS OF "AFFECTIVE" RESPONSES

KNOXVILLE, KENTUCKY

	YES		SOMEWHAT		NO		UNDECIDED	
QUESTION*	PRE	POST	PRE	POST	PRE	POST	PRE	POST
#9	7	13			5	3	5	1
#10	5	12	8	0	2	0	2	5
#11	5	14	8	3	4	0	0	0
#12	4	9	0	0	6	3	7	5
#13	2	7	4	0	5	2	6	8
#14	9	7	7	6	0	0	1	4
#15	4	13	2	4	0	0	11	0

*Question numbers refer to following page.

KNOXVILLE, TENNESSEE

ITEM ANALYSIS- - - - "AFFECTIVE" OR "OPINION" ITEMS

PRE-TEST N=17	YES	SOME-WHAT	NO	UNDE-CIDED
9. If you had a change to study about Food and Kindred Products, do you think you would enjoy it?	7	5		5
10. Do you think that Food and Kindred Products appears interesting enough to recommend to your friends?	5	8	2	2
11. Do you feel that you have a good general understanding of Food and Kindred Products although you have not studied it?	5	8	4	
12. Do you think you might like to work in some area of the food industry as an adult?	4		6	7
13. Given the chance, do you think that the food industry sounds worthwhile and interesting enough for you to spend extra study time on?	2	4	5	6
14. Do you think ninth and tenth grade students should have a chance to study food & kindred products?	9	7		1
15. Do you feel that studying this unit, food & kindred products, will help you in later years?	4	2		11
POST-TEST				
9. Did you enjoy studying this unit, Food & Kindred Products?	13		3	1
10. Would you recommend this unit.. to your friends?	12			5
11. Do you feel that you now have a good general understanding of many areas within this unit...?	14	3		
12. Do you think you might like to work in some area of the food industry as an adult?	9		3	5

	YES	SOME-WHAT	NO	UNDE-CIDED
13. Would you like to spend more time in class studying this unit.. if given the chance?	7		2	8
14. Do you think ninth or tenth grade students should have a chance to study...?	7	6		4
15. Do you feel that the experience you have had and the information you have gained in the unit..will be of value to you in later life?	13	4		

APPENDIX "K"

CAREER EDUCATION IN MANUFACTURING

FINAL REPORT

OF

CAREER EXPLORATION AND PREPARATION

PILOT TESTS

CONDUCTED AT

SAN DIEGO, CALIFORNIA

A

U. S. OFFICE OF EDUCATION

NEW JERSEY STATE DEPARTMENT OF EDUCATION

FAIRLEIGH DICKINSON UNIVERSITY

PROJECT

PREPARED BY

PAUL E. GELLES, Ph. D.

CAREER EDUCATION CONSULTANT

TABLE OF CONTENTS

I. PURPOSE

II. CAREER EXPLORATION

A. TEACHER EVALUATIONS

III. CAREER PREPARATION

A. HIGH SCHOOL PROGRAM EVALUATIONS

B. JUNIOR COLLEGE PROGRAM EVALUATION

IV. SUMMARY AND RECOMMENDATIONS

V. CONCLUSION

APPENDIX

INTRODUCTION

The pilot tests performed in San Diego, California were under the authority of the joint effort of the U. S. Office of Education, New Jersey State Department of Education and Fairleigh Dickinson University.

Field testing of the materials prepared in Career Education in Manufacturing were considered necessary to determine the appropriateness and adaptability of the written material to practical applications within the academic environment.

It was decided that the Career Exploration (Phase III) and Career Preparation (Phase IV) materials be tested in San Diego, California. Based on this decision, three Junior High Schools were selected to review the materials of the Exploration Phase, three Senior High Schools were selected to test the Preparation Phase exemplars, and one Junior College class was considered appropriate to test the Preparation Phase exemplar relative to entry-level skills required by the manufacturing industries.

The Phase III materials were evaluated by the Junior High School Home Economics teachers. All were encouraged to critically critique the materials and to offer constructive comments within the areas of their expertise.

Phase IV was evaluated by high school metal shop teachers and one mathematics teacher. The suggested teaching outlines were utilized as practical teaching methodology. Teachers were also encouraged to critically analyze the Preparation Phase format and modify the exemplar for considered effectiveness.

The Junior College evaluation was made by a mechanical measurement class which consisted of a variety of student levels. This evaluation consisted of a pre/post test to determine content absorption, feasibility, and effectiveness at the post high school level.

PART I

PURPOSE OF THE PILOT TESTING

The purpose of the pilot testing of the Career Education in Manufacturing Exploration materials was to determine the completeness, content, validity, and expected effectiveness of the selected major group of the manufacturing clusters.

The manufacturing group selected for the Exploration Phase pilot test was Food and Kindred Products, Major Group #20, taken from the Standard Industrial Classification Manual published by the U. S. Department of Labor.

It was intended that a coordinating administrator and participating teachers from the cooperating high schools review the prepared materials for reactions, suggestions and input relative to possible revision of these materials.

Time limitations prohibited the actual incorporation of the pre/post tests and exemplar units in the Food and Kindred Product cluster. However, the participants were asked for comments and criticisms relative to those materials.

Pilot testing of the Career Preparation Phase was established for material validity and effectiveness and also to determine whether the exemplar units were adequate to prepare the student for entry-level skills. The manufacturing core area selected for testing was Inspection and Quality Control. From this manufacturing core selection, one functional area was chosen for pilot testing. The selection was in the mechanical inspection functional phase of the core area.

The Phase IV pilot tests were performed at two different levels of the educational hierarchy for more exposure of the materials. The two areas were:

- High School (Grades 11 and 12)
- Junior College (Grades 13 and 14)

As with the Exploration Phase testing, the high school pilot testing was limited to teacher evaluation of the examplars on mechanical measurement because of the scheduled time of the program.

The Junior College pilot test was made in a mechanical measurement class. However, time was available to develop and incorporate a pre/post test with accompanying item analyses.

Overall intent, therefore, was to coordinate the Exploration and Preparation Phases of the Career Education in Manufacturing Program for relevance to the world-of-work through evaluation of prepared materials and school pilot testing.

PART II

CAREER EXPLORATION (PHASE III)

The Career Exploration Phase of the Career Education in Manufacturing examplar materials were pilot tested by the high school administrative coordinator and junior high school home economics teachers. The materials were evaluated for content and process in accordance with the instructions and format provided them through the media of a Teachers Questionnaire.

The questionnaire consisted of three content questions, eighteen learning activities and associated materials questions, and fifteen process questions. (A copy of the teacher's questionnaire is attached in Appendix A of this report.)

Three junior high schools that participated in the exploration materials review were from San Diego, California. All three junior high schools consisted of students in the seventh, eighth, and ninth grades studying home economics.

The questionnaire analyses consisted of the following evaluations listed by questions in sequence.

Content — (regarding material objectives)

1. Objectives of the materials as an overview were very useful.

2. The objectives did not describe behaviors of the students prior to exposure to the materials in two evaluations, but one teacher thought the materials somewhat described the behaviors of the students.

3. Teacher evaluations indicated that performance objectives should not precisely indicate student behaviors after being exposed to the material. One teacher thought they should indiciate that performance.

Learning Activities and Associated Materials

4. The specified learning activities were considered to be insufficient in variety by the teachers whereas one teacher thought the variety was satisfactory. One of the teachers also thought the learning activities would be boring to the students.

5. The teachers thought that many teaching strategies were unique or innovative while one of the teachers thought only a few of these strategies were unique or innovative.

6. All of the teachers thought the concepts and learning activities were more adaptable at a higher grade level.

7. The learning activities could be incorporated into the regular classroom programs.

8. The introductions were considered to be useful by the active teachers and indefinite to one teacher.

9. The topics were generally accepted as being logically sequenced.

10. The teachers rated the material better than traditional materials available. One teacher thought the material was the same.

11. Comments related to the resource materials were:

    - Level too high for junior high school.
    - Too many concepts for one semester.

12. The teachers felt the experiences suggested in the materials is interesting. One teacher thought the experiences only somewhat interesting.

13. The material included adequate exploration for the learners.

14. The activities were described in enough detail, but one teacher thought they were at a too high level.

15. The information contained in the Guide was considered adequate to prepare teachers to use the materials.

16. The materials were considered to be somewhat helpful in making career decisions.

17. Evaluation procedures described were sufficient.

18. All teachers thought some specific tests may be developed for these materials.

19. Criterion checklists were considered to be necessary.

20. Vocabulary used in the material definitely inappropriate for the junior high schools.

21. Groups of students for whom the materials would not be appropriate:

- Regional Occupational Programs - Food Service
- Difficult for Junior High School
- Difficult for non-readers.

Process

22. Not applicable since programs were not incorporated.

23. There were some local examples of the careers described in the learning activities.

24. Not applicable since programs were not incorporated.

25. School counseling staffs should assist in the following ways by:

- Providing career counseling individually.
- Providing information on how to present career information to students.
- Providing background information on specific students.
- By interpreting background information on school population.

26. The involvement point at which counselors should become involved with these materials were noted as follows:

- Should not be involved (1 teacher).
- Before the material is taught (2 teachers).
- While the material is being taught (2 teachers).
- After the material is taught (1 teacher).

27. Sources of career information that could be used during the instruction phase were considered to be:

- Probably all sources if taught (2 teachers).
- Not known (1 teacher).

28. The time expended in reviewing the materials were:

- Probably more than 12 hours (4 teachers).
- Six to nine hours for review (2 teachers).

29. All teachers would incorporate the materials into the Home Economics Programs.

30. One teacher thought the materials usage would require new teaching strategies or methods. The other teachers did not feel new strategies or methods would be necessary.

31. Two teachers determined that the instructional materials were better than other materials. One teacher thought the materials were worse.

32. In terms of student interest, the materials were considered better by two active teachers and worse by one inactive teacher.

33. The material was considered to better enhance interaction between teacher and students.

34. Should this material be incorporated next year, the following opinions resulted:

- Would incorporate with major modifications.
- Would incorporate with minor modifications.

35. The overall quality rating of this material was considered to be:

- Very good by most teachers.
- Good by one teacher.
- Average by one teacher.

36. The estimated instructional hours expected to use this material were in two general categories, they were:

- Fifteen to twenty hours.
- Five to ten hours.

Observations of the Exploration Reviews

The following general observations were made from the review of the Teacher Questionnaires:

1. The administrative coordinator considered the material as being generally adaptable to the junior high schools and depended basically on teacher interest and student orientations.

2. The material, as written, is too difficult in content, activities, and vocabulary for the junior high school level.

3. Adaptability of the material into existing Home Economics Programs is possible with modification.

4. Topic materials were generally adequate and properly sequenced.

5. The counseling departments are not being utilized effectively under existing organizational structures.

6. Objectives were useful as an overview but not entirely adequate in student behaviors.

7. Teachers were favorable to the incorporation of the modified materials at a future time.

PART III

CAREER PREPARATION

The Career Preparation Phase of Career Education in Manufacturing was tested at two levels of the educational hierarchy in the effort to determine the applicability of the materials relevant to entry-level employment preparation

Pilot testing was therefore incorporated at the senior high school level and also at the junior college level. The following results of the evaluations are presented in two parts in order to clearly segregate the two levels.

A. High School Program Evaluations.

The pilot testing of the exemplar materials was performed at three San Diego, California high schools. The schools and student populations were:

School	Total Student Population	Total Student Population Exposed to Exemplar
1	3,522	85
2	3,925	28
3	1,380	25

Activities used in the evaluation phase were in accordance with Unit #8 of the Career Education in Manufacturing Core Program. The title of this unit was, Inspection and Measurement of Physical Characteristics. (See Appendix B and Section 5 of the Manufacturing Core Program.)

The units of instruction were designed to accomplish the following intent as presented to the metal shop students:

- To provide basic knowledge and skill acquisition experiences about the career fields containing inspection and measurement parameters.

It was intended that the teacher assess the learner familiarity with the proposed subject matter. A pre-test was recommended to indicate the proper entry level of the students. Resources were also provided in the content to supplement and/or reinforce the materials where recommended or necessary equipment was not available.

Time limitations prevented the use of the pre-test at the high school level. This limitation was caused by an unforeseen teacher strike that delayed the start of classes.

The pilot programs were finally incorporated with the following objectives:

1. To develop student "quality awareness" at the high school age level.

2. To influence career pursuit in Quality Control occupations.

3. To determine adaptability of high school students to the world-of-work in Quality Control.

4. To determine school acceptance of a Quality Control instructional program.

5. To establish feasibility of the exemplar materials in the metal shops curriculum.

6. To achieve teacher evaluation of the exemplar instructional program.

7. To determine student comprehension of the course instructional materials.

8. To use equipment specified in the exemplar.

9. To read incremental scales of instruments.

10. To develop an understanding of measurement techniques and their applications.

The approach used to incorporate the exemplar was performed in the following sequence:

- Introduce the learning activities.
- Present conceptual and theoretical aspects of the activity.
- Discuss student resources.
- Evaluate student comprehension.
- Procure student evaluation comments.

Instructors demonstrated the activities which required the use of mechanical set-ups. When facilities were not available, local manufacturing plants were visited to illustrate practical use of the theoretical materials presented.

Upon completion of the exemplar unit presentations the following evaluations were made:

Teacher Evaluations of Exemplar

1. One teacher recommended redesign of the exemplar unit to incorporate more comprehensive goals and objectives with minimum performance objectives.

2. The reference to "learners" should be revised to read "students."

3. More stress be placed on metric conversion.

4. Reference to the "British" system be revised to read "customary" system.

5. There was a lack of equipment in the facilities making it difficult to demonstrate activities.

6. The Weight Unit was not taught as a separate unit but is integrated throughout previous school activities.

7. Acquisition of teaching aids was difficult within time period allotted for the testing.

8. The time limitations were too short to incorporate in total. The material should be interspersed throughout a full school year.

9. Teaching weights and conversion factors would work better if required in mathematics or science classes.

10. Students had difficulty in assessing a need to try to convert from one unit to another.

11. Audio-visual aids were not readily available to support activities recommended.

12. The visual inspection and comparison activities were better adapted to the metal shops than was the weight, scales, lever arms, and spring displacement. Reasons given were:

    - Grading of projects are done by visual inspection.
    - Students could use color to determine workability of metal.

- Students' projects necessitated changing forms of metal and finished projects assumed a required shape.

13. Operating tests suggested were difficult because of material and equipment shortages.

Additional teacher comments relative to the Career Preparation Manufacturing Core Program were as follows:

(5a) Linear Measurement

- Linear distance terminologies were unfamiliar to some students.
- Students have no knowledge of the evolution of measurement nor did they express an interest.
- Students very confused on Metric/English conversion units. Most have difficulty with measurement in general. Metric was therefore not explored at all.

Teacher's Note: The English linear measurement down to 1/16th of the inch should be basic to all students enrolled in senior high schools.

(5b) Linear Gradations

- Students had very much difficulty with fractions.
- Student comprehension of linear gradations was very low.

(5c) Vernier Instruments

- The vernier instruments were not available in the school district and not considered part of the basic shop needs.
- Vernier caliper instruction should be taught after 1" micrometer lesson.

(5d) Micrometer Instruments

- Students relate well with decimals.

- There are many difficulties in student abilities with fraction/decimal conversion.
- Students had difficulty in relating to the tenths, hundredths, and thousandths scale readings.
- Large mock-up scales proved very beneficial to teaching instrument scales.
- Retention of micrometers lesson was good.

(5e) Transferring Dimensions

- Mass production concepts not generally taught in the metal shops.
- Teachers must build any device such as jigs, fixtures, etc. when they are required.
- The 5e unit was considered very vague.
- Equipment not available in the high schools for this lesson.

(5f) Angles and Protractors

- Not generally taught in the metal shops. Bevel protractor and selected geometric figures are taught.

(5g) Go/No-Go Gauges

- Tools not available in the high schools.

(5h) Thread Gauges

- The metal shops have limited American Standard series gauges and are taught with taps and dies lessons.
- The high schools are not equipped with metric gauges.

Student Evaluative Comments

1. More field trips should be taken to supplement the activities materials.

2. The information presented should show the relationship between the activities presented and used in industry at a more basic level.

3. The mathematics should be less complicated.

4. Terminologies and technical language should be at a more understandable level.

5. The intent of the program and related materials were clearly presented and understood.

6. Some of the students indicated an interest in pursuing more education in the measurement and inspection occupational fields.

Observations of the Preparation Evaluations

1. The teachers were cooperative and willing to participate in the pilot testing.

2. The students in general were interested in learning a new skill.

3. The full intent of the activities incorporation was impaired because of the lack of equipment.

4. There was a lack of visual aids and other resources.

5. High school students in the metal shop classes need more preparation in basic mathematics, specifically in fractions/decimals conversion.

6. More emphasis must be placed on metric measurement.

7. The program was compressed into a shorter time period than was desirable and, therefore, limited in-depth teaching of activities.

8. The students related well with physical inspection and comparison activities.

9. A revision of the materials would be necessary for future utilization to ensure teacher adaptability and student understanding.

10. Resources listed in the activities outline should be made available to the using teachers.

B. Junior College Program Evaluation

The junior college program was not delayed because of the teacher strike and was therefore able to be pilot tested in accordance with pre-designed intent. The program was incorporated into one Junior College Mechanical Measurements class which in this situation entitled, "Inspection Techniques and Applications." The course is a core requirement in the San Diego Evening College Associate Degree Program in Quality Control and Reliability. The course number is listed in the catalogue as QC&R 8, Master Number 35101.

The objectives of the course are listed as follows:

1. To introduce the student to the theories and principles underlying physical measurements.

2. To familiarize the student with the various types of measuring tools, gages, and instruments used in an industrial setting in order to effectively plan the use of such equipment.

3. At completion of the course, the student shall be able to demonstrate competency in performing a variety of simple measurements and acceptance decisions using common instruments, tools, and techniques normally employed in quality control and production inspection.

Student Population — The junior college course used for the pilot test consisted of fifteen students of various experience and ages all of which had the objective of learning the new skill of mechanical measurement.

Pre/Post Test — A pre-post test was developed for use during the pilot testing of the mechanical measurement activities listed in Section 5 of the Career Preparation Manufacturing Core Program. The Pre/Post test is illustrated in Appendix C of this report.

The following procedures were used in incorporating the pilot test in this program:

- Application of the Pre-test.
- Presentation of the mechanical measurement lesson activities.
- Practical excercises by student utilization of measuring devices.
- Application of the Post-test.
- Evaluation of Pre/Post test results.

The test was developed in four parts. They were:

Part A	—	Multiple Choice Questions, 48 in total.
Part B	—	True-False Questions, 18 in total.
Part C	—	Completion Questions, 12 in total.
Part D	—	Performance tests, 12 in total.

The results are illustrated in the following item analysis of the pre and post tests presented by section for clarity of review.

COMPARISON OF PRE AND POST PILOT TESTS

SECTION "A" — MULTIPLE CHOICE

QUESTION NO.	PRE TEST INCORRECT	POST TEST INCORRECT
1	0	1
2	2	0
3	3	1
4	2	0
5	1	0
6	3	0
7	0	0
8	3	0
9	4	0
10	7	3
11	3	1
12	7	4
13	8	2
14	10	4
15	4	3
16	3	3
17	3	3

SECTION "A" — MULTIPLE CHOICE (CONTINUED)

QUESTION NO.	PRE TEST INCORRECT	POST TEST INCORRECT
18	7	2
19	6	4
20	6	2
21	4	1
22	Deleted	Deleted
23	3	3
24	Deleted	Deleted
25	5	1
26	4	1
27	4	1
28	1	1
29	1	0
30	5	3
31	3	0
32	2	1
33	2	3
34	6	2
35	5	2
36	6	1
37	9	7
38	5	3
39	4	3
40	9	4
41	Deleted	Deleted
42	8	3
43	3	1
44	10	1
45	11	4
46	5	1
47	9	0
48	6	3
	203	83
	11 Tested 45 Questions 495 Possible Errors 203 Tallied 41% Incorrect	9 Tested 45 Questions 405 Possible Errors 83 Tallied 20% Incorrect

SECTION "B" — TRUE-FALSE TEST

QUESTION NO.	PRE TEST INCORRECT	POST TEST INCORRECT
1	0	1
2	7	4
3	7	6
4	7	3
5	6	7
6	5	2
7	10	6
8	5	1
9	4	4
10	2	1
11	6	3
12	11	7
13	8	1
14	11	9
15	2	1
16	6	8
17	9	1
18	8	4
	114	69

11 Tested 114/198 x 100 = 58%
198 Possible Errors Incorrect

9 Tested
162 Possible Errors
69/162x100=43% Incorrect

SECTION "C" — COMPLETION TEST

QUESTION NO.	PRE TEST ERRORS	POST TEST ERRORS
1	9	7
2	11	6
3	8	5
4	8	3
5	8	2
6	9	4
7	8	4
8	10	6
9	9	5
10	10	7
11	11	7
12	10	6
	111	62

132 Possible Errors
111/132x100 = 34% Incorrect

108 Possible Errors
62/108x100 = 57%
Incorrect

SECTION "D" — PERFORMANCE TEST

Demonstrate Ability to use basic inspection hand tools.

Measurement Tests:

1a. Using decimal inch ruler to measure length of shaft.
* Initial Test (3) Incorrect - Final Test (1) Incorrect

1b. Using metric ruler to measure diameter of counter sink.
* Initial Test (3) Incorrect - Final Test (1) Incorrect

2. Using telescope gage and micrometer caliper to measure I.D.
* Initial Test (1) Incorrect - Final Test (1) Incorect

3a. Using decimal inch vernier caliper to measure length.
* Initial Test (7) Incorrect - Final Test (1) Incorrect

3b. Using metric vernier caliper to measure an outside diameter.
* Initial Test (9) Incorrect - Final Test (3) Incorrect

4a. Using dial caliper to measure a stud length.
* Initial Test (1) Incorrect - Final Test (1) Incorrect

4b. Using dial caliper to measure an outside diameter.
* Initial Test (3) Incorrect - Final Test (1) Incorrect

5. Using vernier protractor to measure an angle.
* Initial Test (7) Incorrect - Final Test (3) Incorrect

6. Using horberg pins and micrometer caliper to measure the diameter of a bolt hole circle.
* Initial Test (5) Incorrect - Final Test (4) Incorrect

7. Using a decimal inch vernier caliper to measure the diameter of a bolt circle.
* Initial Test (7) Incorrect - Final Test (4) Incorrect

8. Using a decimal inch depth micrometer to measure counter bore depth.
* No Initial Test - Final Test (2) Incorrect

9. Using a decimal inch inside micrometer caliper to measure an inside diameter.
* No Initial Test - Final Test (2) Incorrect

Pre Test: 11 People - 7 Tests or 77 Possible Errors. Results: 46 Errors or 60% Incorrect. Post Test: 9 People - 9 Tests or 81 Possible Errors. Results: 24 Errors or 30% Incorrect.

A summary of the Pre/Post Test is illustrated in the following matrix chart:

Test Section		Possible Errors	Number Tallied	Percent Incorrect	
				Pre Test	Post Test
A	Pre Test	495	203	41%	
	Post Test	405	83		20%
B	Pre Test	198	114	58%	
	Post Test	162	69		43%
C	Pre Test	132	111	84%	
	Post Test	108	62		57%
D	Pre Test	77	46	60%	
	Post Test	81	24		30%

Improvement indicated after the pilot-testing materials were presented are clearly illustrated in the matrix above. A summary to further indicate the comprehension of the materials presentation are noted below:

	Possible Errors	Errors	Percentage
Possible Errors in Pre Test	902	474	52.5%
Possible Errors in Post Test	756	238	31.5%
Improvement Differential			21.0%

A review of the Pre/Post evaluation statistics indicate a twenty-one percent improvement of material comprehension that resulted from the pilot testing of the Career Preparation Manufacturing Core materials.

Observations of the Preparation Evaluation

The following observations after incorporating, reviewing, and evaluating the pilot test in a junior college class.

1. The time allotted to the pilot test in a formally designed course was more conducive to materials presentation.

2. Students were more interested in learning the materials presented because many were already familiar with the manufacturing world-of-work and had specific job objectives.

3. Tools and visual aids were more readily available for demonstration and student usage.

4. The developed pre/post test assisted the instructor to more readily assess the pilot testing objectives. Other benefits of the pre/post test were:

   - Gave the students a better perception of what was expected in the program.
   - Provided for a broad analysis of specific question adaptability.
   - Assessment of question type was made obvious relative to percentage errors.
   - Students were able to comprehend more through multiple association.
   - Provides a media for more effective evaluation of student progress and incorporated materials.

5. The pilot test materials were very beneficial in assisting student association with the world-of-work, especially in Inspection and Mechanical Measurement.

PART IV

SUMMARY AND RECOMMENDATIONS

The pilot testing of the Career Preparation materials was performed in the effort to determine the adequacy of the program and its validity in preparing entry-level students for the world-of-work. This intent was accomplished in that it did indicate student interest in a variety of ways. Some of these interests were:

- The exploration phase indicated that the materials were potentially better than materials now used in the Home Economics junior high school classes.
- Time limitations for explorations of careers should be longer and more extensive.
- Counseling services in junior high schools should be expanded and made more aware of career exploration opportunities.
- Students in metal shop programs were interested in inspection and mechanical measurement entry level skills.
- High schools are somewhat limited in industrial skills preparation because of the shortage of equipment and visual aids.
- The Career Preparation materials are very adaptable to junior colleges where the students are already familiar with the world-of-work.

Generally, the Career Exploration and Career Preparation Phases of Career Education in Manufacturing are very necessary in preparing youth for the world-of-work. It is apparent, from the experiences of this Career Education in Manufacturing Program, that many students at the junior high school and senior high school levels are in need of assistance in seeking an occupational career choice.

Considering these observations and summations, the following recommendations are offered for future considerations:

1. Career Education in Manufacturing should be incorporated at all levels of the educational hierarchy in the effort to prepare students for the real world-of-work.

2. Exploration of the manufacturing occupations should be made at the junior high school level to influence student awareness of occupational potentials.

3. The exploration of industrial pursuits should begin at the seventh grade level and gradually be stressed to influence occupational choice prior to high school entry.

4. All efforts should be made to assist and encourage high schools to equip and encourage students to enter the world-of-work with realization that the majority of students will not enter college.

5. The Career Education in Manufacturing programs should be publicized so that schools and manufacturing industries are made aware of the interests and efforts being made to assure job realizations for all interested students.

6. Efforts should be made to incorporate and encourage junior colleges to participate in Career Education in Manufacturing Programs since it appears that students at these levels are more aware of the needs in the real world of manufacturing.

7. The occupational field of inspection and quality control should be stressed since it is a contemporary emphasis and a major profession in the manufacturing industry.

8. The Career Preparation phase of Career Education in Manufacturing should be expanded and funded for a more meaningful study. Funding should be made to permit a minimum of one year of in-depth study at the senior high school level.

9. A pilot program of exploration should be extended for a longer period of time to be more meaningful and realistic. The exploration exemplar and associated materials should require at least one year of in-depth study.

10. High school administration should be encouraged and be made aware of the benefits and occupational potential of the manufacturing industries.

PART V

CONCLUSION

The Career Education in Manufacturing is a very good attempt at preparing the high school student for the world-of-work in manufacturing. Exploration of the manufacturing world-of-work is an area that needs in-depth study and extended effort.

It is evident that young students are aware of future employment needs but are not encouraged formally to explore the potential to the extent that is should. Therefore, programs are needed on a permanent basis to introduce students to the world-of-work and the many avenues that lead to future occupations.

Teachers are generally interested in preparing students for the future but are handicapped by the lack of equipment, resources, visual aids and financial support from appropriate sources. Administrators also realize these needs but are not as effective as possible since formal encouragement such as Career Education in Manufacturing Program is limited.

The junior college evening programs should be utilized in the development of Career Education in Manufacturing since they are more adaptable and flexible in the incorporation of new programs.

Career Education in Manufacturing is a very encouraging program relative to preparing youth for the world-of-work in manufacturing and should be continued in greater depth to ensure greater exposure and a more meaningful preparation media.

ATTACHMENT "K-1"

DEVELOPMENT DRAFT

CAREER EDUCATION IN MANUFACTURING

TEACHERS QUESTIONNAIRE

PLEASE COMPLETE THE FOLLOWING QUESTIONS CONCERNING THE CAREER EDUCATION IN MANUFACTURING (EXPLORATION) MATERIALS AFTER YOU HAVE READ AND/OR USED THE MATERIALS. THIS WILL PROVIDE INVALUABLE INFORMATION THAT WILL BE USED IN REVISING THE MATERIALS.

GRADE LEVEL Junior High

DISTRICT San Diego Unified

NUMBER OF STUDENTS 120,000

SCHOOL Marston Junior High

DATE December 19, 1974

THANK YOU

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TEACHERS QUESTIONNAIRE

CONTENT

1. Were the objectives useful in obtaining an overview of this material?

   a) Very useful

   b) Somewhat useful

   c) Not useful

2. Did the objectives describe behaviors that most of your students would have been able to demonstrate before they were exposed to the unit?

   a) Yes

   b) Somewhat

   c) No

3. Should there be performance objectives for this material which would precisely indicate the behaviors your students should exhibit after being exposed to the material.

   a) Yes

   b) No

LEARNING ACTIVITIES AND ASSOCIATED MATERIALS

4. In general, the learning activities specified:

   a) Were satisfactory.

   b) Provided an insufficient variety of ways to learn the concepts taught in the unit.

c) Required very specific skills (e.g., musical skills, artistic skills) not possessed by most teachers.

d) Were boring to most students.

5. Were any unique or innovative teaching strategies suggested to you by the learning activities?

a) A great many

b) Many

c) A few

d) None

6. Do you feel the concepts and related learning activities are appropriate for the grade level you teach?

a) Yes

b) No (What would be better _____)

7. Would the concepts and the related learning activities in this material fit into a regular classroom program?

a) Yes

b) Somewhat

c) No

8. How useful were the "Introduction" sections at the beginning of each topic in helping you prepare your students for engaging in the associated learning activities?

a) Useful

b) Can't say

c) Not useful

9. Are the topics logically sequenced?

a) Yes

b) Not sure

c) No

10. How would you rate this material compared with materials traditionally made available to teachers?

a) Better

b) Same

c) Worse

11. Please list below any resource materials suggested that you feel need substantial improvement (e.g., they present too many concepts at one time, they present ideas too rapidly, they are poorly developed or produced, they are not usable as directed, etc.).

_____

_____

12. Do you, as a teacher, find the experiences suggested in these materials interesting to present to learners?

a) Yes

b) No

c) Somewhat

13. Do you think that the activities described in enough detail relative to what is to be done, how, and when?

a) Yes

b) No

c) Somewhat

Please explain briefly: _____

_____

14. Do you think that the activities provide adequate exploration of the Manufacturing Cluster for learners?

a) Yes

b) No

c) Somewhat

Why? _____

_____

15. Is the information contained in the Guide adequate to prepare teachers to use the materials and conduct the activities?

a) Yes

b) No

c) Somewhat

Please explain: _____

_____

16. Do you think that the use of these materials will help students relative to making their own career decisions?

a) Yes

b) No

c) Somewhat

Please explain: _____

_____

17. Are the evaluation procedures described sufficient for teacher needs?

a) Yes

b) No

c) Somewhat

18. Should specific tests be developed for these material?

a) Yes

b) No

c) Maybe

19. Should some type of criterion checklist be developed for use by teachers to monitor learners?

a) Yes

b) No

c) Maybe

20. Is the vocabulary in this material appropriate for the grade you teach?

a) Yes

b) No (Please specify what grade _____)

21. Are there any groups of students for whom these materials would not be appropriate?

a) Yes (Please specify the groups) _____

_____

b) No

PROCESS

22. Did any learning activities in this material require a unrealistic length of time to complete?

a) Yes (Please indicate the topics and activities)

_____

_____

Use back of page if more space is needed.

b) No

23. Were there local examples of the occupations or careers described in the learning activities?

a) For most

b) For some

c) Very few

d) None

24. How did the school counseling staff assist you in teaching this material? (Circle all that are appropriate.)

a) Provided information on how to present career information to students.

b) Interpreted background information on school population.

c) Provided background information on specific students.

d) Provided career counseling to students on an individual basis.

e) I am not aware of any assistance provided.

f) There is no school counseling staff at our school.

25. How should the school counseling staff assist in the teaching of this material? (Circle all that are appropriate)

a) By providing information on how to present career information to students.

b) By interpreting background information on school population.

c) By providing background information on specific students.

d) By providing career counseling to students on an individual basis.

e) By teaching some of the activities.
(Please specify:)

_____

_____

f) No assistance is really desirable.

26. At what point do you feel the school counseling staff should be involved in the implementation of these materials? (Please circle all that are appropriate.)

a) Before the material is taught.

b) While the material is being taught.

c) After the material is taught.

d) Should not be involved.

27. Identify the sources of career information that were used during the instruction? (Circle all that are appropriate.)

a) DICTIONARY OF OCCUPATIONAL TITLES.

b) OCCUPATIONAL OUTLOOK HANDBOOK.

c) Locally organized or developed occupational materials.

d) Commercially produced occupational materials.

e) Other sources (Please specify)

_____

_____

f) None were used.

g) None were really needed.

28. Approximately how many hours did you spend in preparation time before or while teaching this material?

a) 0 to 1

b) 1 to 3

c) 3 to 6

d) 6 to 9

e) 9 to 12

f) More than 12 (Please specify _____)

29. If you taught this material by integrating it into an existing subject area, in which of the following subject areas did you teach it? (Circle more than one area, if appropriate.)

a) I did not integrate this material into an existing subject area.

b) Art

c) Business and Office Education

d) Foreign Languages

e) Health Education

f) Home Economics

g) Industrial Arts

h) Language Arts/Reading/English

i) Mathematics

j) Music

k) Physical Education

l) Science

m) Social Sciences

n) Special Education

o) Distributive Education

p) Trades and Industry

q) Vocational Agriculture

r) Other (Please specify)

30. Did these materials require that you use different or infamiliar teaching strategies or methods? (Relative to your usual teaching pattern)

a) Yes

b) No

c) Somewhat (Please explain)

_____

_____

31. In comparison with other instructional materials, how would you rate this material in terms of student learning?

a) Much better

b) Better

c) Same

d) Worse

e) Much worse

32. In comparison with other instructional materials, who would you rate this material in terms of student interest?

a) Much better

b) Better

c) Same

d) Worse

e) Much worse

33. Compared to the standard curriculum, how well did this material enhance interaction between you and your class, and the community at large?

a) Much better

b) Better

c) About the same

d) Worse

e) Much worse

34. If possible, would you teach this material to your students next year?

a) Yes, with no modifications

b) Yes, with minor modifications

c) Yes, with major modifications

d) No

35. Overall, how would you rate the quality of this material?

a) Very good

b) Good

c) Average

d) Poor

e) Very poor

36. Estimated the number of instructional hours spent with this material.

a) 5 to 10

b) 10 to 15

c) 15 to 20

d) 20 to 25

e) 25 to 30

f) More than 30 (How many _____)

DEVELOPMENTAL DRAFT

DEVELOPMENT DRAFT

CAREER EDUCATION IN MANUFACTURING

UNIT NAME: #8. Inspection and Measurement of Physical Characteristics

GENERAL INFORMATION

The following exemplar set of activities is designed in order to provide basic knowledge and skill acquisition experiences about the career fields containing inspection and measurement parameters. Because this type of general measurement activity is most common in every day life, the learners should not have difficulty in accomplishing these activities.

The teacher should assess the learners familiarity with the proposed subject matter content. A Pre-Test is recommended in order to indicate the proper entry point. When the recommended or necessary equipment or material is not found within the school system, special mention is made in the Resources Column listing which indicates ways of locating such equipment or suitable substitutes.

ACTIVITY: 8a. Weight; Scales; Level Arms; and, Spring Displacement - in Inspection & Measurement Activities.

GOAL: The learners will acquire knowledge about the origin, meaning and applicatior of units of weight & areas of utility.

OBJECTIVE: The learners will be able to identify the British and Metric weight system units, the equivalencies between the two systems and the factors of conversions from one to the other.

LEARNING ACTIVITIES	LEARNING RESOURCES	EVALUATION
REVIEW GENERAL CONCEPT OF WEIGHT — The instructor should review the physical laws relating to weight - What is it? Why? How? Once learners have gained sufficient understanding of the concept of weight and it's properties, the instructor can introduce the discussion of how man has defined weight units and how man has developed methods for measuring weight.	Film: Metric System. 16mm. Sound Color. 13 min. NBC Educational Enterprises, 30 Rockefeller Plaza, New York, N. Y. 10020.	
REVIEW BRITISH WEIGHT UNITS (Grain, Dram, Ounce, Pound, Ton) - The instructor should be sure that learners are familiar with the British weight units. Learners already familiar with the above, need only to review the table provided. Learners not familiar with British units and conversion factors will need additional instruction. A set of British weights should be available for demonstration.	Resource Sheet listing British Weight Units A set of British weights. A scale-balance (ounce or pound scale is suitable although metric would be better).	The instructor may have learners complete the review questions which cover the three learning activities. Responses will indicate learners understanding of the activities, and will assist the instructor in deciding what lesson entry point is appropriate. The responses may indicate that these activities are unnecessary for the majority of the learners. In this case the instructor should arrange review sessions for learners who need further practice.

ACTIVITY: 8a. Weight; Scales; Level Arms; and, Spring Displacement - in Inspection & Measurement Activities.

GOAL: The learners will acquire knowledge about the origin, meaning and application of units of weight & areas of utility.

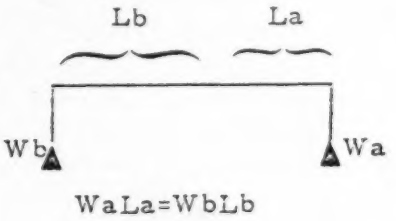
OBJECTIVE: The learners will be able to identify the British and Metric weight system units, the equivalencies between the two systems and the factors of conversions from one to the other.

LEARNING ACTIVITIES	LEARNING RESOURCES	EVALUATION
REVIEW METRIC WEIGHT UNITS (Miligram, Gram, Kilogram, Metric Ton) Follow the same procedure as for the review of British weight units.	Resource Sheet listing Metric Weight Units. A set of Metric weights. A scale-balance.	
REVIEW CONVERSION FACTORS & THE EQUIVALENCY OF METRIC AND BRITISH UNITS The instructor should be sure that the learners: (1) are able to convert from one system to the other; and, (2) are able to state equivalencies of one unit to another. Learners unable to do this will require practice sessions with the necessary cognitive skills relating to the conversion and equivalency of Metric and British weight units.	Resource sheet listing conversion and equivalency factors between British & Metric weight units. Filmstrips: - Metric System. 35mm. Color. 40 frames. Popular Science Publishing Co., 355 Lexington Avenue, New York, N. Y. 10020. - The Metric System of Measuring. 35mm. Color. 52 frames. Encyclopedia Britannica Educational Corp., 425 N. Michigan Avenue, Chicago, Ill. 60611. - Measuring Things (Series). Coronet Films. Includes filmstrip on Measuring Weight among other titles.	As an alternative the instructor may hold a discussion with the learners and through questions and answers assess the general level of knowledge.

ACTIVITY: 8a. Weight; Scales; Level Arms; and, Spring Displacement - in Inspection & Measurement Activities.

GOAL: The learners will be familiar with the concepts and applications of level arm and spring displacement principles in balances and scales.

OBJECTIVE: The learners will be able to explain and to demonstrate the lever arm as used in a balance and in a scale.

LEARNING ACTIVITIES	LEARNING RESOURCES	EVALUATION
BALANCES: REVIEW OF LEVEL ARM PRINCIPLES The use of a balance beam should be demonstrated during the class discussion. The learners can be divided into small groups of 4 or 5. Each group should have a balance (or the necessary materials to construct one) and a set of weights. The learners should practice using the balance and answer questions such as: What happens to the amount of weight at each end when the fulcrum or pivot point is moved? Assign simple weighing tasks: Prepare sealed boxes of paper clips with different numbers of clips in each box. One box should be marked "full" and used as the standard against which students will compare the other boxes. Using a balance learners should determine which of the unopened boxes is: (1) full; (2) not-full; (3) too-full. A brief report should be made by each group. Any number and type of object can be used for such a demonstration exercise.	A general Physics text should be available for reference. A Physics Lab Manual will provide demonstration suggestions. If students are to construct their own balances and scales, the shop teachers should be contacted to arrange for the necessary materials to be prepared by the shop students. General reference materials relative to job opportunities requiring knowledge of weight and measurement should be available for student use. General Teacher Reference: Handbook of Industrial Metrology and Functional Inspection Techniqués, Soc. of Mfg. Engineers, Dearborn, Michigan.	Learners should also be starting to identify the kinds of jobs in which a knowledge of weight and measuring of weight is important. Learners should be able to identify and explain the basic equation:  WaLa=WbLb

ACTIVITY: 8a. Weight; Scales; Level Arms; and, Spring Displacement - in Inspection & Measurement Activities.

GOAL: The Learners will be familiar with the concepts and applications of level arm and spring displacement principles in balances and scales.

OBJECTIVE: The learners will be able to explain and to demonstrate the lever arm as used in a balance and in a scale.

LEARNING ACTIVITIES	LEARNING RESOURCES	EVALUATION
SCALES: REVIEW OF LEVER ARM PRINCIPLES A scale should be demonstrated during the class period. Review the basic principles and introduce the two basic types of scales which use level arms: (1) Fixed lever arm length - varying weights. (2) Fixed weights - varying lever arm lengths. The learners should practice with both types of scales. Learners should also be given practical problems to solve which involve the lifting of something heavy with something which is much lighter. (A 200 lb. man lifting a 500 lb. rock by using a lever.) Other examples would be to discuss how a building crane works. Or how weight is considered in the design of buildings, cars, bicycles, etc.	Filmstrip: Basic Principles of the Analytical Balance. 35mm. B&W. 100 frames. U. S. National Audiovisual Center, Washington, D. C. 20409. $5.00 Filmstrip: Measuring Weight. 35mm. Sound. Color. Coronet Instructional Films. Filmstrip: Meter Stick and Balance: Their Limitations. 35mm. Color. 42 frames. Herbert M. Burdek Co.	The instructor should review the student progress. Indicate student progress on the Criterion Checklist.

ACTIVITY: 8a. Weight; Scales; Lever Arms; and, Spring Displacement - in Inspection and Measurement activities.

GOAL: The learners will be familiar with the concepts and applications of lever arm and spring displacement principles in balances and scales.

OBJECTIVE: Learner will be able to explain and to demonstrate the principle of spring displacement & its applications in weight measurement.

LEARNING ACTIVITIES	LEARNING RESOURCES	EVALUATION
PRINCIPLES OF SPRING DISPLACEMENT USE IN WEIGHT MEASUREMENT The instructor should demonstrate simple spring displacement in the class. For demonstration purposes a pre-marked board and spring should suffice. Another interesting demonstration is the combination of lever arms and spring displacement. After the demonstration, students should discuss how weight is measured by devices using the spring displacement principles. The instructor should review the basic physical laws which describe spring displacement and note limitations such as yield point. APPLICATION OF SPRING DISPLACEMENT USE IN WEIGHT MEASUREMENT. During class discussion, learners should cite examples of spring displacement in weight measurement from their daily lives (i.e. produce scales). Develop a list of examples of every day weight measurement, specifying spring displacement examples. SUMMARY ACTIVITY: Plan a class visit to a local business where various kinds of weight measurements are performed. An on-site visit provides students with opportunities to see routine use of weight measurement devices & instruments. Arrange a visit from local representative of the Bureau of Weights&Measures or	The instructor should have materials necessary to construct the demonstrations or to allow groups of learners to do the construction. Shop students may design and make basic lots of materials for use in making simple lever and lever/spring balances and scales. Again, job information should be available so students can begin to identify occupations in which knowledge of weight measurement using lever arms and spring displacement is required. Filmstrip: Basic Principles of the Analytical Balance. 35mm. B&W. 100 frames. U. S. National Audiovisual Center, Washington, D. C. 20490. $5.00 Filmstrip: Measuring Weight. 35mm. Sound. Color. Coronet Instructional Films. Filmstrip: Meter Stock & Balance: Their Limitations. 35mm. Color. 42 frames. Herbert M. Burdek Co.	Using the review items and/or demonstration exercises the instructor can assess learner knowledge and understanding of lever arm and spring displacement principles and applications.

ACTIVITY: 8b. Visual Inspection and Comparison: Color, Form and Magnification.

GOAL: Students will be familiar with visual examination techniques associated with measurement of physical characteristics.

OBJECTIVE: The students will be able to explain and/or to demonstrate the purpose and application of visual examination techniques related to color, workmanship, and shape; and to identify occupations using these tools and techniques.

LEARNING ACTIVITIES	LEARNING RESOURCES	EVALUATION
VISUAL INSPECTION FOR COLOR Prepare classroom demonstrations which illustrate: (1) the comparison of similar items of different color; and, (2) the use of different sources of light (sunlight, fluorescent, incandescent) which effect visual color tests. Supplement demonstrations through classroom discussions of: (1) how, where, and why visual tests for color are used; (2) properties of various light sources; and (3) differing abilities of humans to discriminate colors (vital to visual color inspection). VISUAL INSPECTION OF WORKMANSHIP Shop students can prepare samples for use in demonstrations of visual inspection of workmanship, such as: solder joints; general configuration (bent or misaligned parts); and, surface finish (scratches and blemishes). Learners should practice and discuss workmanship inspection & its application in industry. NOTE: It is recommended that sample inspection checklists be provided for learners to use in performing workmanship inspections. CLASS DISCUSSIONS FOR ALL OF THE ABOVE ACTIVITIES SHOULD FOCUS ON: WHO, WHERE AND WHY THESE EXAMINATION TASKS ARE PERFORMED.	Similar objects of different colors. Lights suitable for use at work station (florescent, incandescent). Materials which test light source phenomena (spectrum, tone, eye strain). Materials which test human visual color discrimination capabilities. Resource materials on color differentiation should be available. Shop students can prepare the samples for use in demonstrations of workmanship inspection. Local business firms can provide input and assistance with these activities (i.e. plumbers, cabinet makers, etc.). Discussion Topics: Paint Store: Where did they get colors from? Why? Polaroid film-Why? How to synthesize color? Drivers license eye test is a good example of use of measurement.	The instructor should assess the student knowledge of: 1. Purpose for visual examination techniques; 2. Application of visual examination techniques; 3. Industries which use these techniques; 4. Occupations which use visual examination of physical characteristics.

ACTIVITY: 8c. Operating Tests

GOAL: Students will be familiar with various tests associated with the measurement of physical characteristics.

OBJECTIVE: The students will be able to explain the purpose and application of operating, hardness, destructive, leak, shock, and vibration tests; and, to identify occupations using these tools and techniques.

LEARNING ACTIVITIES	LEARNING RESOURCES	EVALUATION
OPERATING TESTS FOR TV, RADIO, ETC. The instructor should arrange for demonstrations of operating tests conducted on televisions, radios, electronic calculators, and other types of electrical appliances. Students should have access to appropriate resource materials relating to performance tests. Whenever possible students should conduct sample performance tests using operating test checklists. Focus class discussion on who, where, and why performance tests are used.	Contact local TV and radio repair people for expert information, resource material, and possible classroom demonstrations of operating tests. Resources, materials, and standard job descriptions should be available for student reference.	The instructor should review student progress based on: 1. Participation in various tests; and, 2. Understanding of tests. The instructor should assess student knowledge of: 1. Test application and purpose; 2. Industries which use these tests; and, 3. Types of persons who conduct these tests (engineers, inspectors, etc.).
HARDNESS TESTS & DESTRUCTIVE TESTS The instructor should have the necessary materials and resources to demonstrate: (1) hardness tests (for grading and treating and selecting metal products); (2) destructive tests for yield strength (metals); and, (3) break point (plywood and glue) metals. To gain practical awareness, students should participate in conducting such tests. Focus class discussion on who, where, and why such tests are used.	Invite a representative from industry to make a presentation on hardness and break point testing. Samples of materials and products should be available. Students should perform simple tests in class. Shop students may provide the necessary materials.	

ACTIVITY: 8c. Operating Tests.

GOAL: Students will be familiar with various tests associated with the measurement of physical characteristics.

OBJECTIVE: The students will be able to explain the purpose and application of operating, hardness, destructive, leak, shock, and vibration tests; and, to identify occupations using these tools and techniques.

LEARNING ACTIVITIES	LEARNING RESOURCES	EVALUATION
LEAK TESTS The instructor should arrange a demonstration of leak testing of sealed units. Focus class discussions on the types of products that would be tested in this way, noting industries that would conduct such testing. Learners should have the opportunity to conduct simulated leak tests if materials such as tubing and connectors are available. SHOCK AND VIBRATION TESTING The instructor should arrange simple activities which simulate shock and vibration conditions to test for use conditions or design strength. Have students construct models of products and conduct tests under simulated conditions. Have students think of TV commercials which relate to shock and vibration testing (auto commercials in particular). While introducing the concepts of shock and vibration testing, the class discussions should focus on who, where, and why.	Tire Tubes (water submersion) Engine compression testing; Tubing (rubber, plastic, metal); fillings; and some form of pump to introduce pressure into a closed system. Invite firms and businesses (e.g. car radiator repair) to provide information and assistance with demonstrations. Or arrange to have class see demonstration of compression tests on car engines. Discussion Topic: Food company sealing cans & botulism. What is shelf life of cans? Why? Shop students can prepare samples of items for shock and vibration testing (e.g. wodden boxes fastened together using different methods).	

ATTACHMENT "K-3"

PRE/POST TEST

A. Multiple Choice - Choose the test answer and place the letter preceding your choice in the space provided.

1. The earliest recorded dimensional standards were related to: (a) the stars, (b) the sun, (c) parts of the body, (d) a distance a man could jump. _____

2. Until the 19th century, standards for measurement were decreed by (a) the mechanic's guild, (b) the reigning sovereign, (c) the grand vizier, (d) parliament. _____

3. The ultimate standard for U. S. units of measurement, used to verify all masters, is: (a) The Geiger counter, (b) the official meter, (c) the imperial yard, (d) the length of a light wave. _____

4. A chief reason precision measurement is essential to modern industrial production is because parts: (a) must be completely interchangeable, (b) must have a clean, bright finish, (c) must conform to metric equivalent, (d) must meet military specifications. _____

5. In precision measurement procedures, tolerance refers to (a) recognizing validity of other (metric) system, (b) clearance between mating parts, (c) permissible limits of variations from exact size, (d) longest perpendicular dimension. _____

6. A common observational error in reading rule measurement, called parallax, is caused by: (a) using wrong scale on rule, (b) using a hook rule, (c) reading scale from an angle, (d) twisting the rule.

7. A scale graduated in 100th of an inch also shows: (a) 64ths, (b) 10ths, (c) 32nds, (d) 8ths. _____

8. A narrow rule is used in a depth gage to: (a) reduce weight, (b) make reading easier, (c) slide easier in head, (d) permit measuring smaller holes. _____

9. A hardened steel square is more accurate than a combination square because it: (a) is made of hardened steel, (b) is heavier, (c) combines blade and beam in one piece, (d) is lighter. _____

10. The hermaphrodite caliper is distinguished by: (a) difference in legs, (b) wider spread, (c) sharper points, (d) black finish. _____

11. When using an inside or outside caliper, care must be taken to get the proper: (a) grip, (b) feel, (c) depth, (d) slip. _____

12. The vernier makes measurement readings as fine as thousandths of an inch possible by: (a) visually subdividing the smallest divisions on a scale, (b) magnifying the graduations, (c) geometric progression, (d) providing more closely spaced graduations. _____

13. When the length of 24 main scale divisions is divided into 25 equal parts on the vernier scale, the difference in width between a main scale division and a vernier deivision is: (a) .0025", (b) .049", (c) .001", (d) 24/25". _____

14. When a vernier measurement is an exact multiple of .025", the number of vernier lines which coincide exactly with opposite lines on the main scale is (a) none, (b) 1, (c) 3, (d) 2. _____

15. The purpose of the small screw and knurled nut connecting the two parts of the vernier jaw is: (a) for final, sensitive adjustment of jaw setting, for accurate reading, (b) to provide compensation for wear, (c) to permit adjustment to nearest .025", (d) for conversion of inside to outside reading. _____

16. The graduations on the barrel of a micrometer represent divisions of: (a) .001, (b) .005, (c) . 025, (d) .010. _____

17. The graduation on the thimble of a micrometer represent divisions of: (a) .001, (b) .005, (c) .025, (d) .010. _____

18. The smallest size a 3" micrometer can measure is: (a) 1", (b) 2", (c) 3", (d) 2.500". _____

19. The numerals on the barrel of micrometer mark division of: (a) .020", (b) .050", (c) .025", (d) .100". _____

20. The finest reading possible with a vernier micrometer is: (a) hundred-thousandths, (b) thousandths, (c) ten-thousandths, (d) micro-tenths. _____

21. The micrometer feature that helps users get consistent, correct "feel" is the: (a) clamp ring, (b) friction sleeve, (c) barrel sleeve, (d) friction adjust nut. ____

22. The surface plate is essential to precision measurement because it provides: (a) a reflecting surface, (b) an accurate reference surface, (c) a wear-resistant work table, (d) a vibration-proof work surface. ____

23. The principal use of V-blocks is holding, in fixed relation to the surface plate: (a) angular pieces, (b) stacked parts, (c) cylindrical pieces, (d) measuring tools. ____

24. The first characteristic of a workpiece usually checked on the surface plate is: (a) squareness, (b) roundness, (c) height, (d) flatness. ____

25. The Height Measuring Unit design and operation is based on which of the following principles? (a) vernier, (b) micrometer, (c) protractor, (d) metric. ____

26. The feature practically all measuring instruments used on a surface plate have in common is: (a) an accurately finished base, (b) sliding jaws, (c) scales reading to .0001", (d) graduated thimbles. ____

27. A contact instrument much used in comparative gaging on the surface plate is the: (a) divider, (b) flexible rule, (c) sine plate, (d) dial indicator. ____

28. The most important function of precision measurement in modern industry is: (a) testing thickness of metal, (b) preventing theft of costly parts, (c) inspecting parts for conformance to specification, (d) checking machine set-ups. ____

29. A gage made to check a single dimension (and tolerance) is called a: (a) fixed gage, (b) vernier gage, (c) micrometer gage, (d) varigage. ____

30. Gages that tell how much a dimension varies from specification are called: (a) depth gages, (b) accurators, (c) tolerators, (d) indicating gages. ____

31. In metal-working specifications, tolerance means: (a) clearance between mating parts, (b) permissible variation from specified dimension, (c) allowance for difference in finish, (d) oversize to allow for wear. ____

32. If a blueprint dimension reads -3" plus or minus .002", the total tolerance is: (a) .002", (b) .001", (c) .004", (d) .003". _____

33. In a GO and NO GO plug gage made to check a hole diameter specified as - 2" plus or minus .001", the larger end diameter would measure: (a) 2.001", (b) 2.002", (c) 1.999", (d) 2.0025". _____

34. The measuring range of dial indicators in common use does not exceed: (a) .500", (b) .005", (c) 1.000", (d) 3.50". _____

35. Comparison measurement checks the dimensions of a workpiece against the known size of a piece called the: (a) model, (b) master, (c) proto, (d) copy. _____

36. A workpiece, made to a specification of 2" dia., is checked with a dial comparator gage. The actual diameter is found to be 2.004". The part of this dimension measured by the dial indicator is: (a) .004", (b) .002", (c) 1.000", (d) 2.004". _____

37. In a dial indicator graduated in .001" increments, the allowable error for the full travel of the indicating hand is: (a) .005, (b) .001", (c) .010", (d) .0001". _____

38. The zero setting of a dial indicator is changed by rotating the: (a) contact point, (b) bezel screw, (c) spindle, (d) bezel. _____

39. The distinguishing feature of the optical comparator is that adjustments for measurement are observed on a: (a) screen, (b) dial indicator, (c) reticle coordinator, (d) rotating stage. _____

40. The indicating meter of the most refined electronic measurement amplifier is graduated in increments of: (a) .00020", (b) .0001", (c) .000005", (d) .000001".

41. The relation of a millionth of an inch to one inch is the same as that of a single 25 cent piece in a stack of quarters: (a) as high as the Empire State Bldg., (b) 1 mile high, (c) 1/2 mile high, (d) as high as Mt. Everest. _____

42. Precision measuring instruments use different ways to achieve the same objective, which is: (a) to convert one system to another, (b) to reduce number of manipulations, (c) to amplify small variations in measurement, (d) to convert fractions to decimals. _____

43. The first gage blocks produced for international use in metalworking became popularly known as: (a) G Blocks, (b) norms, (c) J standards, (d) Jo Blocks. _____

44. The description square, rectangular or cylindrical, applied to a gage block, refers to the shape of its: (a) transverse section, (b) projection, (c) top, (d) container. _____

45. The number of combinations possible with a typical set of 81 gage blocks is (a) 5,000, (b) over 100,000, (c) over 10,000, (d) 200,000. _____

46. The method whereby several sizes of gage blocks can be conveniently combined to total a desired dimension is called: (a) stacking, (b) wringing, (c) interlocking, (d) magnetism. _____

47. The procedure used to restore measuring instruments to original precision capabilities is called: (a) synchronizing, (b) elevation, (c) calibration, (d) correlation. _____

48. Under proper use of the procedure you named in Question No. 47, the realiability of a measuring instrument is linked to the U. S. National Standards by: (a) confirmation, (b) tracability, (c) unification, (d) capability. _____

B. True - False. Choose the one correct answer and circle the T or F.

1. Accuracy, precision, and reliability do not mean the same thing but are highly related terms as applied to measurement. T F

2. The required discrimination for a particular measurement has no bearing upon the scale to use. The smallest scale must be used in all applications to achieve reliability. T F

3. The taper plug gage measures the amont of taper through depth of insertion of the gage in the work piece. T F

4. The true reading is not the total obtained from the basic scale and vernier scale of the vernier caliper. T F

5. The tri-cal universal vernier caliper is quite similar to the vernier caliper but has one additional feature which is depth measurement. T F

6. The precision square measures the angle of a work piece. T F

7. Parallels should be used on the surface plate to elevate work, only when necessary. T F

8. One disadvantage of surface plates is that they are highly limited in application. T F

9. The number of tools which may be used in conjunction with surface plates is virtually unlimited. T F

10. Gage blocks provide physical form to industrial length standards. T F

11. Gage block accessories limit the use of gage blocks to a large degree. T F

12. When building combinations, one should work from left to right in the desired figure, choosing the least number of blocks possible. T F

13. Proper application of sine instruments in angular measurement is dependent upon the sine instrument complementing the angle of the work piece. T F

14. The repeatability of dial indicators should be within one-half of a unit division for successive measurements. T F

15. The range, discrimination, and sensitivity of dial indicators are relatively unimportant considerations in selection of the proper instrument for a particular application. T F

16. One disadvantage of the toolmaker's microscope is that it does not present an image in true perspective, but upside-down and backwards. T F

17. The basis of operation of electronic gaging equipment is through application of a balanced bridge in an electrical circuit. T F

18. One limitation of electronic gaging equipment is that it is quite difficult to select the best scale for a particular application, according to the discrimination required to measure reliably. T F

C. Fill in Blanks - Choose the correct word or words that best answer the question and put in the blank provided.

1. When using a rule, the point measured from is called the _____ _____.

2. When using the rule, the point measured to is called the _____ _____.

3. Four uses of the combination square are to: (1) _____, (2) _____, (3) _____, (4) _____

4. Since dividers and calipers have no graduation for direct measurement, they are used mainly to _____.

5. Name the principal parts of a micrometer caliper:
(2) _____, (3) _____, (4) _____,
(5) _____.

6. Give four reasons for the increasing perference for granite surface plates:
(1) _____, (2) _____,
(3) _____, (4) _____.

7. Name four of the common types of fixed or adjustable gages:
(1) _____, (2) _____,
(3) _____, (4) _____.

8. What are the two principal parts of a pneumatic gaging system?
(1) _____, (2) _____.

9. Name four of the many uses of gage blocks in metalworking manufacturing.
(1) _____, (2) _____,
(3) _____, (4) _____.

10 The principal parts of an electronic gaging system are: (1) _____ _____, (2) _____.

11. Electronic gages can be used to take two measurements simultaneously and indicate the _____ or _____.

12. Gage blocks are the standards used most extensively for calibrating other instruments because they are: (1) _____, (2) _____,
(3) _____, (4) _____.

PERFORMANCE TESTS

(DEMONSTRATE USE OF MEASURING EQUIPMENT)

1a.	Use decimal inch ruler and measure kitchen sink diameter. Record results. (Item #1)	1a. _____
1b.	Use metric ruler and measure kitchen sink diameter. Record results. (Item #1)	1b. _____
2.	Use telescoping gages and micrometer caliper to measure I.D. Record results (Item #2)	2. _____
3a.	Use vernier caliper to measure I.D. in decimal inches. Record results (Item #3)	3a. _____
3b.	Use vernier caliper to measure I.D. in the metric system. Record results. (Item #3)	3b. _____
4a.	Use dial caliper to measure I.D. of Item #4. Record results.	4a. _____
4b.	Use dial caliper to measure O.D. of Item #4. Record results.	4b. _____
5.	Use vernier protractor to measure angle between two surfaces on Item #5. Record results.	5. _____
6.	Use Horberg pins and micrometer caliper to measure largest bolt hole circle diameter. Record results. (Item #6)	6. _____
7.	Use vernier caliper to measure smallest bolt hole circle diameter. Record results. (Item #6)	7. _____

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